CAMPUS COMMUNITY RECYCLING STRATEGY FOR McMASTER UNIVERSITY HAMILTON, ONTARIO

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Report Prepared for:
Waste Management Branch
Ontario Ministry of the Environment

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The enthusiastic assistance and co-operation of numerous individuals and departments in the University, MUMC, and the Region of Hamilton-Wentworth in the development of the McMaster Community Recycling Strategy is gratefully acknowledged.

FOREWORD

This project is entitled a "Recycling Strategy", however it is important to note that the context of the term "recycling" in this case has been applied in a generic sense to comprise the 4R's as defined by the Ministry of the Environment. Throughout the conduct of the subject investigations, and the development of recommendations, the 4R's principles which have been considered are:

Reduce - to generate less waste (i.e. reduce use of disposable cafeteria wares)

Reuse - to divert materials from the waste stream by using them again in their original form for the same or a different purpose (i.e. reuse wooden skids or the reverse of printed paper)

Recycle - to separate distinct waste materials at their source and divert them to appropriate markets for processing again into useful products (i.e. beverage containers)

Recover - to extract materials or energy from mixed waste (i.e. composting)

All of these measures have been addressed in one or more areas of the Recycling Strategy.

It is also important to note that a comprehensive recycling program must consider the principal mandate and objectives of the University. In this regard, appropriate waste management strategies should be applied to produce net benefits for the University and the community.

Usually, the aggressive implementation of effective recycling measures will achieve this goal. However, in certain instances, some moderation must be practised to ensure that the pursuit of recycling is not conducted in a manner that is detrimental or counter-productive to the normal function of the University and its various components. Experience has proven that simple principles applied without reasonable prudence and judgement often lead to significant disruptions. Without due regard to practical considerations, these disruptions can result in the termination of worthwhile endeavours if timely remedies are not effected.

Therefore, the strategy recommended for the McMaster community focuses on the 4R's principles applied in a practical manner, and with a high expectation of acceptance and success. Although many other options can be added to the subject program, these are best developed as supplements to the essential macroscopic strategy submitted.

It should also be recognized that the implementation of the Recycling Strategy is not a one-time limited effort. Rather, it is a challenging undertaking that will require ongoing attention, management, and refinement, supported by the positive attitudes and broad commitment of the campus community.

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CAMPUS COMMUNITY RECYCLING STRATEGY FOR McMaster University

December, 1989

1.0 EXECUTIVE SUMMARY

The conduct of this study, and the development of a community recycling strategy for McMaster University and the McMaster University Medical Center, has revealed a great deal of active interest and initiatives already in place with respect to recycling. Of special note are the various waste reduction and recycling programs that are observed in several departments, and in the student based McMaster Recycling Initiative. A summary of these programs is provided in the body of this report.

The existence of these efforts provides an available base of awareness and experience from which to launch an effective comprehensive campus-wide recycling strategy. Although these programs are achieving results on a small local scale where they are in effect, a structured and well-publicized recycling plan with consistent performance standards and objectives is essential to generate significant and consistent results. The most important aspect of a successful recycling program will be the education/information process to be delivered to the campus community. This is a task which the student Recycling Initiative is well prepared to perform, with the participation of the University administration. To provide direction towards recycling objectives,

the development and application of appropriate official policies is essential to ensure widespread interest and involvement in the campus program. These policies can be implemented through a proposed Recycling Committee that will direct, monitor and plan the conduct of the recycling strategy.

To maintain continuity and consistent direction, a full-time staff position of Waste Management Co-ordinator is proposed. Appendix H provides an outline of associated duties.

Because of market volatility for recyclables, and the relatively small, although significant, quantities of recoverables available from the campus waste stream, the establishment of a storage and processing center by the University is not recommended. Instead, a systematic network of building and office collection points, with attractive and functional outdoor storage buildings to contain the recyclables in a secure manner, is proposed. The collection and removal of recovered materials is to be performed by an outside recycling agent, probably co-ordinated through the Regional/City municipal recycling program. The recycling strategy is structured for maximum efficiency and best use of available resources, however, it is estimated that about two additional person-days of work per week will be required of custodial staff in the performance of associated activities.

Projected waste diversions to be achieved by the recycling program are estimated as:

1990	:	20%	:	448 tonnes
1991	:	35%	:	784 tonnes
1992	:	50%	:	1120 tonnes

These figures are calculated from a base annual waste quantity of 2240 tonnes for the campus. It is possible that, considering the expense of a Waste Management Co-ordinator, the 1990 recycling

program net cost will be about $23,500 after government subsidies are applied. However, with the announced increases in disposal fees (from $80/tonne to $110/tonne in January 1990), and increasing waste diversions, it is expected that the recycling program can yield a net saving of about $21,300 in 1991, rising to an estimated $84,000 for 1993. These savings may vary subject to the effectiveness of the recycling program and market conditions for recyclables. Income revenue has not been considered in the noted cost/saving summary; some payments may be received for recovered fine paper and corrugated cardboard, thereby improving the program's operating budget.

Based upon this review and conclusions, it is recommended that McMaster University and the McMaster University Medical Center proceed with the establishment of a formal Campus Community Recycling Strategy in accordance with the details submitted in this study.

The proper application of the 4R's (Reduce, Reuse, Recycle, Recover) as defined by the Ministry of the Environment places a priority on the avoidance of waste creation. Because of the significant operational considerations usually associated with this 4R component, specific "micro-strategies" are best developed within individual departments as supplements to the measures defined in the Recycling Strategy. A basic approach in this respect may consider eliminating or reducing the use of certain products or materials, eliminating certain activities, and revising purchasing practices.

It is expected that the existing recycling programs on campus will be maintained as necessary while the new structured scheme is phased in. During the interim period, promotional and educational programs and expanded activities should be initiated, while funding and new equipment is pursued. With diligent efforts, the new recycling strategy should be fully in place and operational within 12 to 18 months of a decision to proceed.

2.0 SUMMARY OF RECOMMENDATIONS

1. Establish a formal Recycling Committee as described herein, or a suitable version thereof.

2. Establish a formal recycling policy under the title of McMaster University Campus Community Recycling Strategy.

3. Initiate applications for capital and operating funding as described herein.

4. Establish the position of Waste Management Co-ordinator.

5. Commence development and delivery of education/information programs.

6. Proceed with staged implementation of a comprehensive recycling program.

Appendix K provides an ordered list of Suggested Activity Priorities for early attention. These programs may be developed in more detail by the proposed Waste Management Co-ordinator.

3.0 FINANCIAL CONSIDERATIONS

3.1 Funding Programs

Currently there are two government funding programs, one at the federal level and one at the provincial level, which are available to encourage sustainable development in environment related areas.

3.1.1 Environmental Partners Fund

Environment Canada has established a three to five year funding program to encourage local projects which will enhance the environment by promoting environmental awareness and sustainable development. Programs which support waste reduction and recycling will also be considered. Under the program the Federal Government will match funds for a project to a maximum of $200,000. Funding is available for labour, materials, equipment and services, and takes into account volunteer service as a matching contribution by the proponent.

In order to qualify for funding, proposals must be submitted which describe existing conditions and how they would be improved by the project.

Proposals are evaluated and awards are announced three times per year. The deadlines for applications are the first day of March, June and September.

Application kits can be obtained by writing or calling Environmental Partners Fund, Environment Canada, 25 St. Clair Avenue East, Toronto, Ontario M4T 1M2, (416) 973-6467.

3.1.2 Industrial 4Rs Program

The Ministry of Environment Industrial 4Rs Program was established in 1987 to assist in the implementation of waste reduction and recovery programs in areas other than municipal programs.
Grants are available for capital costs to a maximum of 50% of the total eligible costs.

Proposals outlining projects should be submitted to the Ministry of Environment's Waste Management Branch.

3.2 Cost/Benefit Analysis

The following history of disposal fees, in the Region of Hamilton-Wentworth, is presented for reference:

TABLE I

Disposal Fees History

Date	Fee
January 1, 1986	$24.50/tonne
January 1, 1987	$27.00/tonne
January 1, 1988	$28.60/tonne
January 1, 1989	$43.90/tonne
May 1, 1989	$80.00/tonne
January 1, 1990 (new)	$110.00/tonne

The waste disposal tonnages recorded for the University and MUMC from September, 1988 to August, 1989 were 2,237 tonnes. These may be considered as a base line quantity to project future disposal costs. However, the figures will be conservative because the campus population is increasing each year, and total waste generation can normally be considered to increase accordingly in the absence of

effective reduction and recycling programs. With certain assumptions for waste diversion based upon projections noted in Section 4.2 Recommended Diversion Objectives, the financial implications of the proposed recycling program are presented in Table II.

Table II indicates that, after the first year of an established recycling program, there are significant savings to be obtained in avoided disposal fees. Once a successful program is established, savings can be expected to accrue annually. It is emphasized that all figures are estimates based upon the best available information at this time. If, due to circumstances, the diversion quantities or disposal fees vary, the outcome of this analysis will change. However, the noted evaluation is considered to be conservative and reasonable. Because of the conservative analysis applied, wage escalations over three years have not been considered in the annual operating cost review. Note also that the analysis does not consider any credits for recovered materials. Revenue may be obtained for recoverables such as fine paper and corrugated cardboard, but the uncertainty of future markets leads to this potential source of revenue being ignored at this time. Another unknown factor is whether or not the University may be required to contribute financially to the operation of collection and recycling activities by an outside agency such as the Region or the City of Hamilton. Although this is not considered likely, it remains a possibility that can arise in the future.

In Table II, the estimated annual recycling costs assume a 25% subsidy of the $62,500 annual expense for the Waste Management Co-ordinator, and extra custodial time, for Years 1, 2 and 3; and no subsidy after Year 3. Also included in these costs is the amortized expense of the unsubsidized portion of the equipment cost noted in Table III.

This cost is calculated as:

* 50% x $346,000 = $173,000
* 10 year amortization @ 10% interest/yr.

  = $(173,000 x 1.5) ÷ 10 = $25,950

Total annual recycling cost:

(75% x $62,500) + $25,950

= $46,875 + $25,950

= $72,825

A method of measuring recovered quantities of materials, and maintaining records for each component would be desirable. The simplest approach is to obtain weights from the recycling agent for total recoverables removed from campus. Alternatively, average weights, and material composition ratios, could be established for full bags of recyclables, and records then kept on the basis of container counts.

TABLE II

Cost/ Benefit Analysis

Year	Quantity of Waste (Tonne)	Disposal Fee ($/Tonne)	Total Annual Disposal Cost	Projected Annual Diversion (Tonnes)	Projected Annual Disposal Fee Savings	Estimated Annual Total Recycling Costs	Recycling Program Net Annual Savings
1989	2,240	$ 62.00 (Avg.)	$138,880	N/A	N/A	N/A	N/A
1990 (Yr.1)	2,240	$110.00	$246,400	448 (20%)	$49,280	$72,825	($23,545)*
1991 (Yr.2)	2,240	$120.00 (Est.)	$268,800	784 (35%)	$94,080	$72,825	$21,255
1992 (Yr.3)	2,240	$140.00 (Est.)	$313,600	1120 (50%)	$156,800	$72,825	$83,975
1993 (Yr.4)	2,240	$160.00 (Est.)	$369,600	1120 (50%)	$184,800	$88,450	$96,350

* ( ) = deficit

TABLE III

Summary of Program Gross Costs

Before Subsidies

A: Equipment Costs

	Item	Estimated Number	Estimated Unit Cost	Estimated Total Cost
1.	Individual workstation receptacles	6,000	$10	$60,000
2.	Floor receptacles			
	- containers	500	$100	$50,000
	- cabinet enclosures	125	$200	$25,000
3.	Outdoor beverage bins	20	$150	$3,000
4.	Building storage sheds (pre-fabricated concrete)	30	$6,000	$180,000
5.	Recycling Station Signs	300	$20	$6,000
6.	Weigh scales	1	$2,000	$2,000
7.	Individual office confidential paper shredders	12-16	$1,500 (avg.)	$20,000
			TOTAL A	$346,000

B: Annual Staff Costs

1.	Waste Management Co-ordinator & vehicle	$50,000
2.	Custodial time: 2 person-days/week	$12,500
	TOTAL B	$62,500

4.0 RECYCLING TACTICS AND ROLES

4.1 Existing Recycling Activities

In Section 7.2, some descriptions of current recycling measures being observed by various areas of McMaster University and MUMC are described briefly. Generally, there have been several commendable initiatives pursued in a number of sectors on campus over the past few years. Many of these began as efforts of the student Recycling Initiative, but others also developed as the result of responsible thought and internal incentives within various groups. As a result, McMaster University is in an advantageous position to undertake a co-ordinated and structured comprehensive recycling program at this time, as much of the foundation for this activity is already in place.

It is apparent that lack of better co-ordination and communication until now has hindered the unification, growth and effectiveness of the fragmented recycling efforts on campus. However, with the assistance of a disciplined plan and campus community education/promotional theme, excellent results should be expected.

The following points will summarize briefly the different recycling activities which are now in place, and will supplement the preliminary overview in section 7.2.

4.1.1 McMaster Computer Information Systems

* approximately 2/3 of purchased CPO paper is a recycled product
* about 500 lbs/week of low-grade CPO is recovered for recycling by Third Sector
* some of the high-grade CPO is recovered for recycling, the rest is destroyed as confidential documents

* recovered paper is stored in cartons in a central area of the second floor where Systems is located (Note: As of December, 1989, Third Sector is no longer able to remove collected paper from individual floors and offices, but will collect it from ground level consolidation areas)

* Systems personnel retrieve high-grade used CPO from the offices where they distribute new reports

* Systems is participating on a committee to review measures to reduce paper waste generation, possibly by substituting video terminals for transmitting information

4.1.2 Food Services

* beverage containers are collected in 45 gallon metal or plastic drums supplied and serviced by Recycling Initiative student volunteers

* commingled beverage containers are taken to a central location and removed by Hotz and Third Sector. Payment for recovered aluminum is used in part to offset rental of a large storage bin, and its pick-up cost. Quantities collected of all materials are about 500 lbs. per week.

4.1.3 Faculty Club

* recovers glass and metal containers for removal by Recycling Initiative

4.1.4 Printing Shop

* pads waste office paper, or printing overruns

* some fine paper stored for removal by an independent agent who delivers it for recycling to Mills Fibres (Note: As of December, 1989, this pick-up service has been suspended)

4.1.5 The Silhouette

* arranges placement of week-old surplus papers into newsprint bins.

* publishes articles on recycling

4.1.6 MSU Graphics

* re-use back of waste fine paper stock; then final product for disposal is stored in a cardboard box for eventual recycling pick-up

4.1.7 The Courier

* prints recycling articles

4.1.8 Grounds Services

* uses donated wood chips from downed trees for mulch and ground cover
* composts leaves collected on campus (14 tons/yr.)
* gives away cut tree sections for firewood (2 tons/yr.)
* recycles about 50% of waste pallet stream by returning some to truckers, and releasing others to staff for firewood.

4.1.9 Student Residences

* 1 recycling center per floor or wing for paper and beverage containers
* 2 student representatives per floor, to handle materials and monitor bins
* 1 representative per residence responsible for overall program within building
* Recycling Initiative performs preliminary establishment of program in a residence, then leaves operation to residents
* all 9 residences now involved
* total of 55 recycling centers
* 1 plastic pail per center for beverage containers
* 2 boxes for paper, 1: fine paper, and 1: newsprint
* independent agent takes fine paper to Mills Fibre (This activity suspended December, 1989)

* Third Sector takes newsprint and beverage containers, which must be placed outside residence in bags on collection day

* no revenue received for materials

* each center collects 1 bin of beverage containers, and 50 lbs. of newsprint weekly. Very little fine paper collected

4.1.10 McMaster University Medical Center

* irregular collection of beverage containers from cafeteria areas

* some fine paper being recovered for collection by Third Sector. No revenue received

4.1.11 Other Activities

* beverage container recycling bins placed around campus property

* newspaper recycling bins situated near outdoor high traffic areas

4.2 Recommended Diversion Objectives

Because a university has different waste and infrastructure characteristics than a typical municipal community, and because universities differ from one another, it is difficult to ascertain suitable recycling goals on the basis of precedent. However, guidelines are available to make reasonable projections, and combined with a visual examination of the McMaster solid waste stream, these two factors provide sufficient information to arrive at an informed estimate.

Data obtained from the Recycling Advisory Council of Ontario statistics suggests that a university with characteristics similar to McMaster's can expect to recover a minimum of about 30% of its waste stream, or approximately 12 to 15 tonnes per week. In

comparison, a curbside Blue Box program initiated at Guelph University this year is achieving recoveries estimated to be between 10 and 20 tonnes per week, or about 30% of the total waste stream.

An examination of McMaster's waste suggests that at least 50% of the waste stream could be diverted from disposal and to re-use; the ultimate level of diversion may be even greater, possibly 70%. In order to achieve these objectives, a well-structured and co-ordinated program of necessary measures, including promotion/orientation pertaining to campus recycling must be developed over a period of two to three years following initiation.

A proposed statement of recycling objectives is indicated in the following table:

TABLE IV
McMaster Recycling Objectives

Year	% Diversion *	Tonnes Diversion
1	20%	448
2	35%	784
3	50%	1,120
Subsequent	to be established	1,120 (minimum)

* Based upon 1988-1989 annual quantity of 2,237 Tonnes

The Year 1 objective of 447 tonnes diversion can be confirmed by reviewing the estimated constituents of the solid waste stream, as detailed in Table VIII. Based upon the assumption that approximately 1/2 of the recoverable materials actually present in garbage can be removed quite easily, the following results are obtained:

TABLE V

Extraction of Recoverables

Component	TPY Present	TPY Recoverable
Total paper	1,230	615
Glass	90	45
Cans	45	23
	Total	683 Tonnes

The anticipated recoverable amount of 683 tonnes is 33% of the total annual solid waste stream. Therefore, minimum diversion objectives of 20% in the first year and 35% in the second year are considered to be conservative and reasonable.

4.3 Comparative Recycling Programs

4.3.1 University of Western Ontario

This university is in the process of implementing a campus wide fine paper and newsprint recycling program. The development and implementation of the program is under the direction of a coordinator who has been hired by the Physical Plant Department of the University.

The program involves the collection of fine paper and newsprint from offices, residences, libraries and other high traffic areas. In offices, materials are collected from fine paper receptacles at each desk by cleaning staff. This is done at the same time as garbage is collected.

In libraries, residences and high traffic areas, a depot system is used. Large bins are placed in convenient locations. Bins are emptied by caretaking staff.

Promotion and monitoring of the program is also done by the Recycling Co-ordinator. The program is expected to reduce the University's garbage by 20-25%.

Cans and glass are not recycled by the university because local markets for these materials do not exist. Additionally, the City of London does not have a curbside recycling program through which to market the materials.

It is estimated that, after receiving revenues from the sale of the materials, the program will have an annual operating cost of approximately $50,000. The Ministry of Environment is funding the purchase of containers and other capital items.

It is interesting to note that the University of Western Ontario has found it feasible to implement a recycling program even though there is no gate fee levied for garbage disposal.

4.3.2 University of Guelph

A pilot recycling program for fine paper, glass, steel and aluminum cans and newsprint was initiated by the City of Guelph in selected campus locations in November 1987, and it has since expanded the program campus-wide. It is estimated that approximately 30% of the University's waste stream is diverted from landfill by the program.

Large 75 gallon bins are placed in convenient locations around the campus. Materials are collected from the bins by the City of Guelph's recycling contractor.
The program is promoted and monitored by the University of Guelph's PIRG (Public Interest & Research Group).

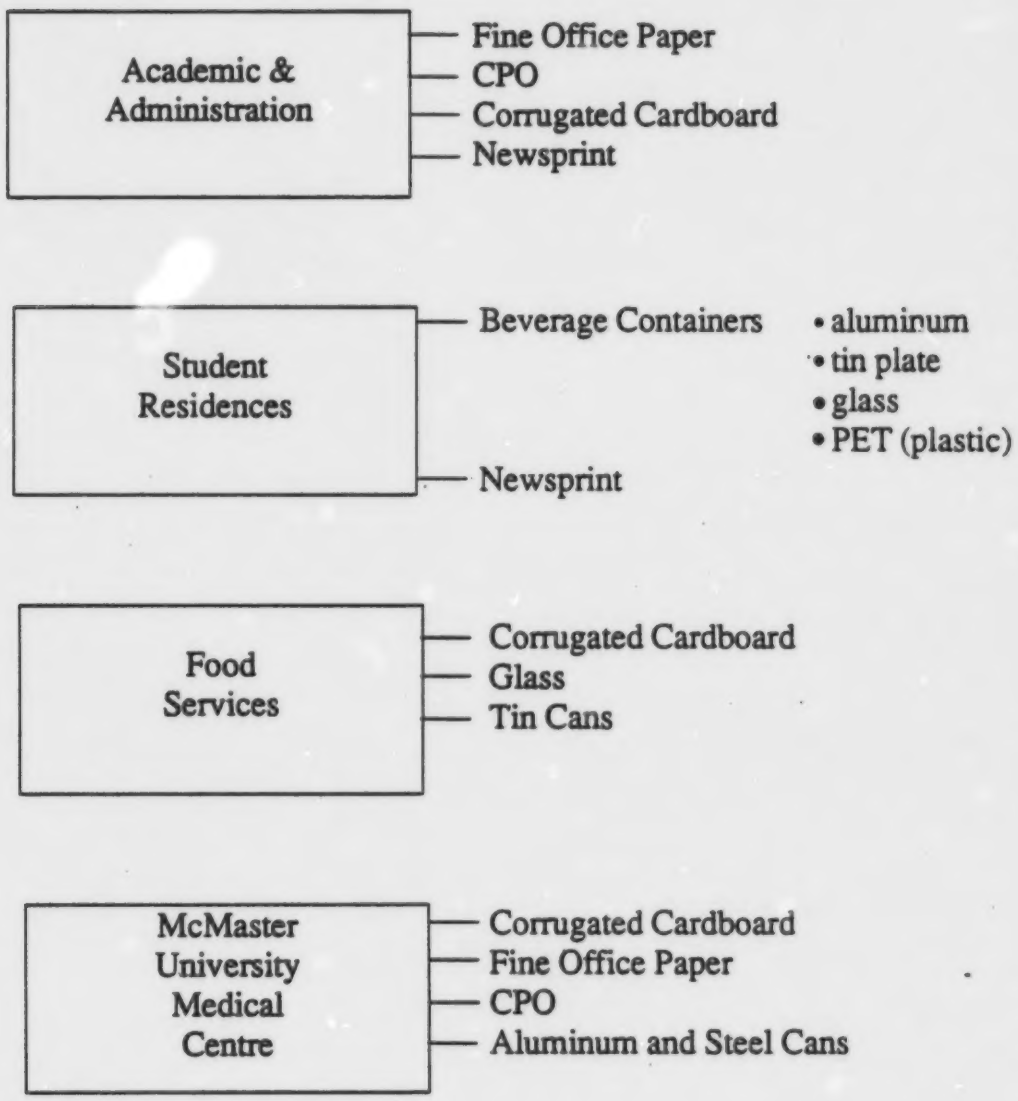
4.4 McMaster Program Basic Approach

The McMaster community already has a number of isolated recycling activities in place around the campus. Although an effective and comprehensive recycling program will require a more extensive and more formally structured program, this task will be assisted as a result of existing initiatives. This evaluation has identified four distinct waste generation sectors, and the principal recyclables associated with them. These sectors are illustrated in Figure 1. The sectors are further divided into various departments and office groups, with different operating procedures and specific internal identities. Therefore, it is not considered appropriate to specify detailed standard procedures and support equipment to be applied equally to all sectors and groups. However, specific concepts for recycling activities are proposed, with the flexibility to be integrated for application in a variety of campus environments. The detailed operation of the individual group recycling systems should be established within each office or department by the managers and staff therein, provided that these measures are consistent with the objectives and workings of the central program. Previous experience indicates that this form of participative involvement usually achieves the most effective results with the least difficulty and effort.

In the development and conduct of the proposed program two major considerations must be addressed. The first is the attitude of the individual participants. The effort and initiative displayed by several groups and departments on campus is very commendable. However, some persons will verbally support a recycling program because it is considered as the right thing to do. However, only some of these individuals will involve themselves on an active and consistent basis to separate and place designated recoverables in the appropriate depots or containers. Some people will participate only on occasions when they are not inconvenienced in terms of time or effort, and will sometimes or often discard recyclables into waste receptacles.

Figure 1

Recoverables Generator Sectors



It is therefore essential, with respect to the first consideration, for the University to establish an official policy concerning its recycling program, and accompany this policy with a suitable education/information plan. The official policy is necessary to elicit the consistent commitment of the general community, while demonstrating resolve on the part of the administration. To enact effective recycling, the necessary means to facilitate the initiation and execution of the program must be supplied concurrent with the issuing of related policy. These means include both "hard resources" (i.e. collection and storage facilities), and "soft resources" (i.e. education and planning). Both forms of resources are necessary to ensure the best *returns* from the University community's recycling efforts.

If possible, a system of recognition or reward may be considered as an additional incentive. This may include such measures as special mention in campus newspapers/newsletters and departmental budgetary incentive credits for waste reduction, reflecting reduced costs of collection and disposal. Specific strategi s in this regard should be evaluated by appropriate members and groups within the University.

In conjunction with the education/information program, the various University/MUMC generator sectors should group together in a structured committee to plan, monitor, and direct the current and future directions of recycling activities. More detail in this respect is provided in Section 4.5 Proposed Methodology.

The second major consideration which is pivotal to the conduct and effectiveness of the recycling program concerns the marketing and sale of recovered products. It is a fact of life that markets and prices for recyclables are fickle and volatile. These difficulties are more pronounced for certain recyclable materials than for others, depending upon market conditions. It is also apparent that, as more recycling programs are developed and the quantities of recoverables inundate the receiving agents, prices paid for most of these

commodities are decreasing rapidly. In fact, the trend in certain areas is for receivers of some recyclables (i.e. processing plants for newsprint, glass) to charge a fee to the recycling collector, rather than pay for the materials received. This is due in part to the fact that the recyclables supply is exceeding the capacity of available markets to accept them, and in part to the processing plant managements' perception that they are performing a "disposal service"; that is, if recycling programs are providing a disposal fee saving to the generator, then the receiver/ processor should share in a portion of that saving by assigning a fee for materials accepted. In extreme cases, volumes of recoverables have exceeded the capacity of receiving facilities to the extent that the materials are not accepted and are directed to landfill disposal. In Ontario, a number of measures have been initiated in an attempt to prevent landfill dumping of recyclables, but it is expected that disposal of some quantities will continue in the next 2 or 3 years until new or larger processing plants are functional. Nonetheless, this fact should not be permitted to discourage recycling. When established recyclable feedstock streams are available, the private sector will develop the plants to process them; many of these ventures are supported by government financial subsidies to encourage such development. Without the presence of suitable feedstocks from established recycling programs, it is unlikely that significant efforts will be directed to the building of processing plants. Additional specific details on markets are provided in Section 8, Materials and Markets.

It is further expected that firmer government guidelines or regulations respecting recycling will be enacted in the near future.

These will probably extend to:

a) the manufacture and role of products and packaging that are recyclable, and,

b) the establishment and conduct of recycling programs in public and private sector activities, and,

c) the use of recycled materials in new products

As a point of interest, the foregoing measures are already in effect in some form in Ontario, as they pertain to government agencies and the beverage industry. It is only a matter of time before their application is more extensive, and the requirements more intensive. In particular, the use of greater quantities of recycled materials in new products is essential for the ongoing long-term success of recycling.

To address the issue of markets for its recovered products, McMaster University must consider an approach that will provide relatively secure outlets. Although the University/MUMC can generate significant quantities of recyclables, these are relatively small in comparison to the provincial recycling streams. If the outlets are not relatively secure and consistent, the University will be confronted eventually with the need to store substantial amounts of recoverables and/or dispose of them through the local transfer stations. Either of these outcomes will be extremely costly and undesirable, particularly when added to the normal costs associated with establishing and conducting the recycling program. To ensure continuing outlets and acceptance of its recyclables, the University must pursue two important features in its program. The first is to establish a formal affiliation with another firm or agency which has an established market access, and/or processing capabilities, for the recoverables. A review of the McMaster waste stream and projected recyclable quantities has determined that a processing or central storage facility is not economically viable at this time or in the near future. Therefore, the proposed role of the University is to accumulate suitably pre-sorted materials, and arrange for their removal from campus by an outside agent. This agent may be either a private sector firm operating under a 3 to 5 year contract with the University, or the Region of Hamilton-Wentworth/City of Hamilton.

The latter option may provide the University with longer-term security for recyclables outlets, and costs of removal. With respect to costs/revenues associated with recycling programs, it is frequently assumed that the revenues obtained from recyclables sales will fully offset all costs of the recycling program, and possibly generate a profit. In fact, the sale of recyclables normally offsets only 50% or less of the total capital and operating costs. For example, most municipal Blue Box recycling programs operate at a cost of about $150/tonne with a net cost of about $70/tonne after revenues. With the recent drop in recovered newsprint prices (newsprint constitutes the largest portion of the municipal recycling stream), the net cost will increase substantially. Offsetting the net cost is the disposal fee saving obtained by diverting a portion of the waste stream for recycling (currently $80/tonne in Hamilton-Wentworth, rising to $110/tonne in January, 1989), and declining government subsidies. The overall margin of savings is considered too narrow for McMaster to risk uncertain markets. Although the Region or City of Hamilton is not expected to indirectly subsidize non-municipal recyclers by providing them with a collection service for their recovered materials, the special profile and image of the University should make it eligible for Blue-Box type collection on the campus. The proposed collection concept is an enhanced "Blue Box" system described in section 4.5 Proposed Methodology. By aligning itself with the municipal recycling program, the University may be able to avoid exposure to fluctuating market prices or outlet costs. A request for a written statement in this respect from the Region and the municipalities' Waste Management Co-ordinating Committee was submitted and the response is attached as Appendix J. If necessary, meetings with appropriate municipal officials can be conducted to establish a satisfactory and mutually acceptable arrangement. At this time, Third Sector Recycling is the collection/recycling agent for the Region's municipalities. However, the Region is now proceeding with a Request For Proposals for recycling services in 1990. Although Third Sector may have a continuing role in local municipal recycling, the extent of the role

cannot be predicted at this time, and it would be premature to enter into a fixed arrangement with this agency now. However, a short-term arrangement, such as that currently in place for campus recycling collection, extended in accordance with the University's program development, may be pursued directly with Third Sector or through the municipal Waste Management Co-ordinating Committee.

Further to the issue of market outlets, the University can secure outlets by providing good quality control for its recoverables. Receivers can be expected to give preference to materials which most closely conform to their requirements for minimum contamination. Because the University will not have its own processing center (in any event, post-collection processing is not the preferred option for achieving good quality control), materials purity is best effected by proper source separation and deposit by the generators. This fact underscores the need for an effective education/information plan and official policy for the whole campus.

In the simplest analysis, the driving principle for campus recycling and waste reduction is to minimize the waste stream destined for landfill or incineration, and conserve irreplaceable material and energy resources. An essential support for this principle is financial viability. An adequate return or saving will provide the foundation to maintain the principle in place. It is not considered necessary for the financial returns to totally offset the program costs, but it is a fiscal reality that net costs must be monitored and controlled as necessary to maintain program efficiency.

With the current trend in disposal fees, it is unlikely that the University will incur net costs for a comprehensive long-term recycling program if it is properly conducted. In proceeding now with the programs, a number of important gains will be realized by the University. These are:

a) enhanced image as a responsible community member

b) projection as an appropriate role model for an institution of learning

c) entry to markets before further deterioration of outlets

d) possibly better access to available subsidy programs

e) as a unique program, this activity can be used as a learning resource for selected curricula.

Previous experience indicates that a well-designed recycling/waste reduction program can also provide indirect benefits by instilling more efficient workplace attitudes and improving the use of other resources.

4.4.1 Recycling System

There are several components to a recycling system, but generally it functions in the following manner:

a) materials are separated at the source by the generator and placed into a container other than a garbage container. Relating this to the residential program, homeowners separate their glass, cans and newspapers and place them into a blue plastic box

b) materials are removed from the source and brought to a central area for temporary storage or final processing, depending upon the quantities of material and location of the "source".

Materials are removed from the source in different ways. Two prevalent options are available. Either the generator brings the material to the central area, or persons other than the generator collect the materials from the generator.

The benefit of collecting materials from the generator is that recycling is made more convenient, tending to increase participation in the program; hence more materials are recovered.

Collecting from every point of generation may not be possible sometimes, and may also increase operating costs.

In order to optimize the amount of recyclable material that is recovered it is important to analyze the current habits of the generator and develop a system which will require the least amount of change in these habits. The success of the program is linked to participation at the source and participation is linked to current disposal habits.

4.4.2 Collection Systems & Containers Options

a) Fine Paper

i) Offices:

There are two principal options available for the collection of fine paper from offices:

* individual paper containers are provided to each desk or work station and individuals are responsible for bringing paper to a central paper bin on each floor or work area
* provision of large collection bins in high generation areas of offices such as in a photocopy room

A combination of these two options is recommended to achieve higher recovery rates of the materials.

As a less desirable option, cleaning staff may collect paper from each individual paper container as this will increase the participation and therefore recovery of the material.

It may be feasible to collect paper and garbage on alternate days in some areas. The collection of both simultaneously will incrementally increase the time required to clean offices, and the additional costs of providing this service must be weighed against the additional savings or revenues generated through this activity.

Individual Workplace Containers

Options available are desk top holders or under-desk containers. Desk top holders are not recommended as they are an additional item on top of the desk reducing the available work space.

Desks which have stacking trays for incoming/outgoing mail may use an additional tray for waste paper. For under-desk receptacles there are a number of small size garbage containers (approximately 2 gallon size) which would be suitable. The containers should be a colour which is distinguishable from garbage containers and usually can be stamped with a logo. Prices are about $10 (including a stamped logo) per container, depending upon quantities ordered.

There are several manufacturers of these containers including Rubbermaid, General Steel Ware and companies which manufacture the Blue Box.

Large containers are required in high traffic areas and central floor bins. When selecting containers it is important to ensure that it is rugged enough for its intended use. A 75 gallon container full of paper weighs approximately 96 kg (200 lbs).

It is also important to select containers which are easily handled and emptied by cleaning staff. Containers should be well marked to indicate their use for recycling.

75 gallon wheeled carts are very popular in recycling programs particularly because they can be mechanically dumped into recycling

vehicles. These carts are typically made of molded polyethylene and are manufactured using one of three processes. The carts vary in their sturdiness and durability, and correspondingly in price. Costs for the containers range from $75 to over $125. Carts are also available in 24, 32, and 64 gallon sizes.

Metal floor bins may also be considered for fine paper, particularly for fire safety reasons. Any metal waste container would be suitable. Suppliers can be found under "Janitorial Supplies" in the yellow pages. A 32 gallon capacity (31 3/4" x 16.5" x 16.5") container with push down lid costs approximately $100. One bin of this size would serve as a central floor collector for approximately 15 employees.

Collection containers should be lined with a removable bag unless they are to be replaced with empty units when they are full. A container full of paper is quite heavy and thick gauge plastic, nylon or burlap bags should be selected. Plastic bags are less expensive per unit than nylon or burlap bags. The nylon and burlap bags are approximately $3 per bag but may be less expensive over time because they can be re-used. If plastic bags are used it is recommended that clear plastic be selected so that separated paper is not confused with garbage.

Plastic bags can be obtained from existing garbage bag suppliers. [1] Burlap bags can be obtained from a local company, Dominion Bag and Burlap Company (Telephone: 560-4000).

ii) Other Areas:

Large containers, used for central collection bins and high population areas in offices, would also be suitable for other high traffic areas on the campus such as photocopier areas and libraries.

Containers could also be placed in residences although the quantities of fine paper generated in these areas is not expected to be significant.

[1] Yellow pages under "Bags - Plastic & Transparent"

b) Glass, Cans, Newspapers

Glass, cans and newspapers are collected by placing receptacles for these materials at convenient locations.

Both indoor and outdoor locations should be considered in order to maximize the amount of materials collected. It is important to select containers which will keep out rain and snow in outdoor locations. Contamination of materials may be a problem in collection containers which are placed in public or common areas. This problem can be minimized by placing collection containers near garbage containers.

Suggested Locations:

Glass - cafeterias, pubs, lounges, high traffic hallways, residences.

Metal - cafeterias, near vending machines, lounges, residences.

Newspaper - cafeterias and lounges, residences

Large containers are essential for these areas to accommodate the volume of materials generated.

The type of container used will depend upon the system used to collect materials from these locations. It should be noted that if the market for the glass and cans is to be the Region of Hamilton-Wentworth's contractor, then these materials can be collected in the same container.

"Alcan" type receptacles for soft drink containers are 45 gallon plastic pails, with metal lids which have a small hole in the lid large enough to fit a beverage container. The cost for the pail is between $30-$50. McMaster currently has a supply of approximately 150 of these containers.

75 gallon rolling carts as described in the fine paper section would also be suitable.

Other garbage containers which are distinctively coloured and well marked should also be considered. Garbage containers which are covered and have a swing door would be suitable for outdoor locations.

It must be determined whether or not containers will be lined with bags. If liners are not used, two sets of collection containers must be purchased, as a unit must be replaced when it is removed. Generally containers lined with clear plastic bags would reduce the requirements for collection receptacles and reduce capital costs. However, ongoing operating costs would be slightly greater for the purchase of bags.

c) Cardboard Recycling

There are three major points of generation for old corrugated cardboard (OCC): Chester New Hall, Commons Building and the Medical Centre.

A proposal prepared for the university by Kargo Waste Equipment indicated that approximately 35 tonnes of OCC are generated at these locations each week. This is a very generous estimate as this implies that 83% of the university's waste stream by weight is OCC.

If space is not available for cardboard handling and storage, then a baler should be considered. As indicated in the markets section of the report, the market for this material is very poor. Therefore, there is no advantage to marketing the materials baled at less than 1,000 lb per bale (millsize) rather than loose. There is minimal increase in revenue for millsize bales. (Millsize bales $10-25/ton).

OCC is generated in other areas on campus; however the quantities would not warrant special containers.

Boxes are generally left for cleaning staff to remove. It would be possible for cleaning staff to bring cardboard to central storage areas for recycling rather than placing the material in dumpsters provided that the storage fixture is not too distant from the building being serviced.

4.4.3 Storage of Materials

The various materials, once collected from receptacles, must be temporarily accumulated until quantities are large enough to be transported to market, or picked up by a recycling agent. For example, the Third Sector agency recently suspended recycling collections from individual offices on various floors of university buildings, because it could no longer afford to assign its resources in this manner. Similarly, the agent which collected scrap fine paper for delivery to Mills Fibres also ceased collections in December.

To resume collections, Third Sector will require reasonably accessible outdoor placement of recoverables; Mills Fibres will pick up fine paper scrap on campus if minimum quantities of one tonne are accumulated.

Because it is not feasible financially or operationally to leave recoverables on campus grounds for collection, nor to have campus staff load and deliver these materials to the recyclers, appropriate storage must be provided. Storage space is not normally available in buildings, therefore small outdoor collection sheds are recommended.

Prefabricated concrete structures are available. A 10' x 12' concrete structure with steel doors is approximately $6,000 including taxes, delivery and installation.

Fire safety is essential when storing large quantities of paper, particularly indoors. Rooms should be equipped with heat sensors and/or sprinklers. It is recommended that the City of Hamilton Fire Prevention Officer inspect and approve storage areas.

4.4.4 Transportation of Materials to Markets

Another consideration in the development of the program is how materials will be delivered to markets.

Materials may be picked up at the University if market prices are favourable. If agents are picking up materials at the University it is desirable to minimize the number of locations from which materials are collected.

Mill Paper Fibres in Hamilton indicated that they would be willing to pick up fine paper from three or four locations on campus, if a minimum quantity of one tonne is available.

4.5 Proposed Methodology

Separate, but similar, mechanisms for recyclables separation, handling, and storage are recommended for each generator sector. The noted procedures consider the particular characteristics and

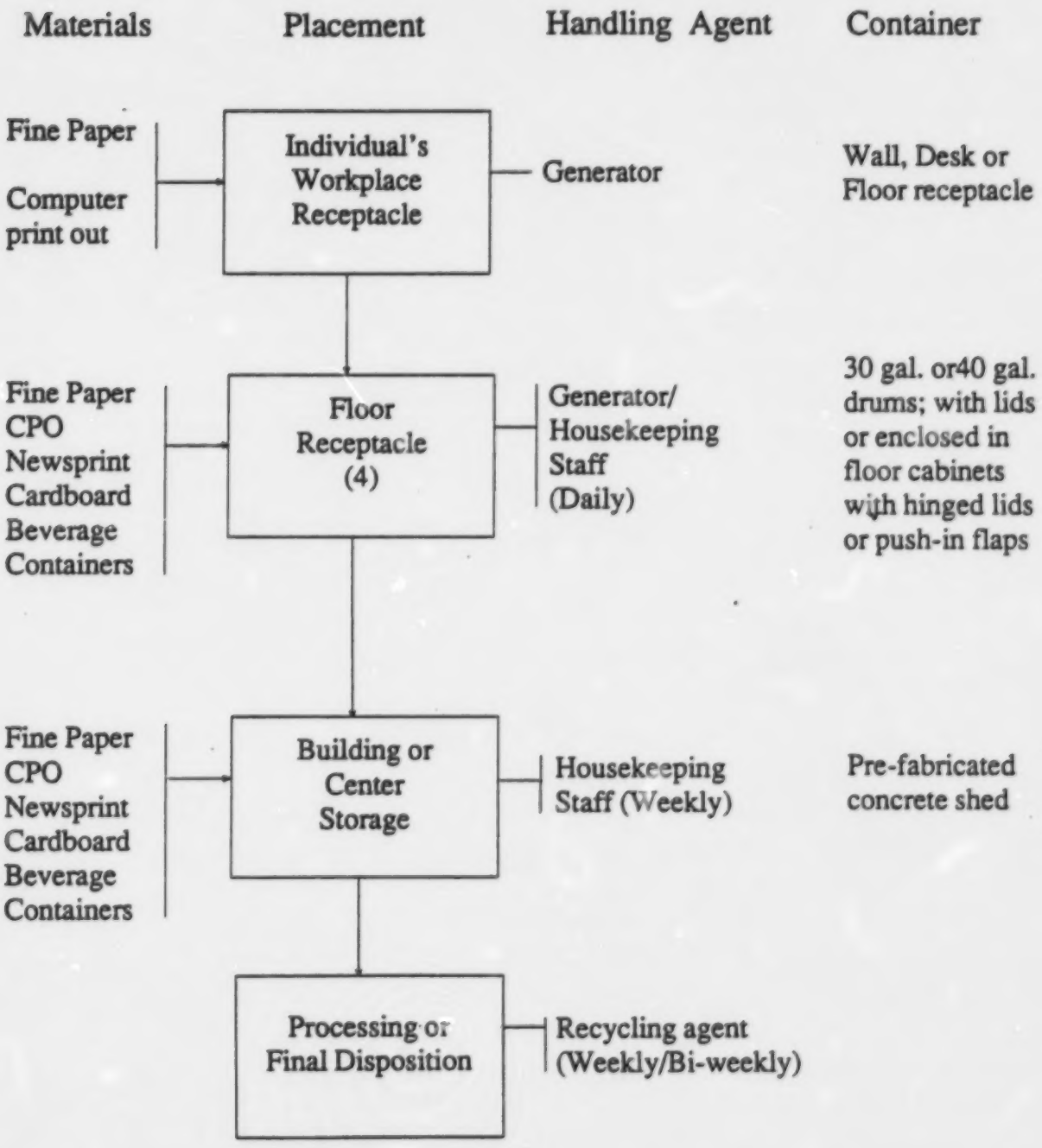
operations of each group. Because each sector is divided into distinct groups or units, the specific types and placement of collection receptacles at individual workplaces are best left to the discretion of each work unit. Certain constraints will apply to this, based upon the cost and availability of standard office equipment. However, the floor collection center and building storage center equipment is generally identical and common to all areas.

4.5.1 Academic/Administration Office Generators

The characteristics of these generation centers are noted briefly in section 4.4 and Figure 1. Figure 2 illustrates the materials, placement, and agent responsible for handling to the designated receptacle.

Figure 2

Academic/Administration Offices Recoverables Stream Flow



4.5.2 Student Residences

The residences are one sector where the services of housekeeping staff are not recommended for handling recyclables. This approach is intended to recognize the function and role of residences and the responsibilities of the residents. The experience and value of residence life can be extended by applying the principles of social responsibility associated with the individual's place in relation to the larger group. An evaluation of the initiatives and results to date in residences is very encouraging as regards the future of a relatively self-directed and governing recycling body.

As a general concept, the residence recycling activities could be co-ordinated by the Inter-Residence Council, with liaison between the Council and the University administration. In consideration of an incentive system, the administration might evaluate the suitability of recognizing good results with added or improved facilities for successful residences. Alternately, a suitable stipend might be established for residents who are actively involved in their building's recycling program; this group would include floor representatives, and a residence recycling co-ordinator. The level of remuneration should be consistent with that paid for similar residence duties, and should reflect a "profit sharing" concept based upon disposal fee savings. As an added consideration for students who work in the program, the experience obtained can be a valuable asset for future job searches. Figure 3 illustrates the recommended material flow for this sector.

4.5.3 Food Services

In the food services sector, there are actually two separate handling and collection areas. These are the staff side (food preparation) and customer side (food consumption). Because these areas are in the same proximity, certain common handling procedures are employed, although the collection containers are situated separately. Figure 4 illustrates the recommended recyclables stream flow.

Figure 3

Residences
Recoverables Stream Flow

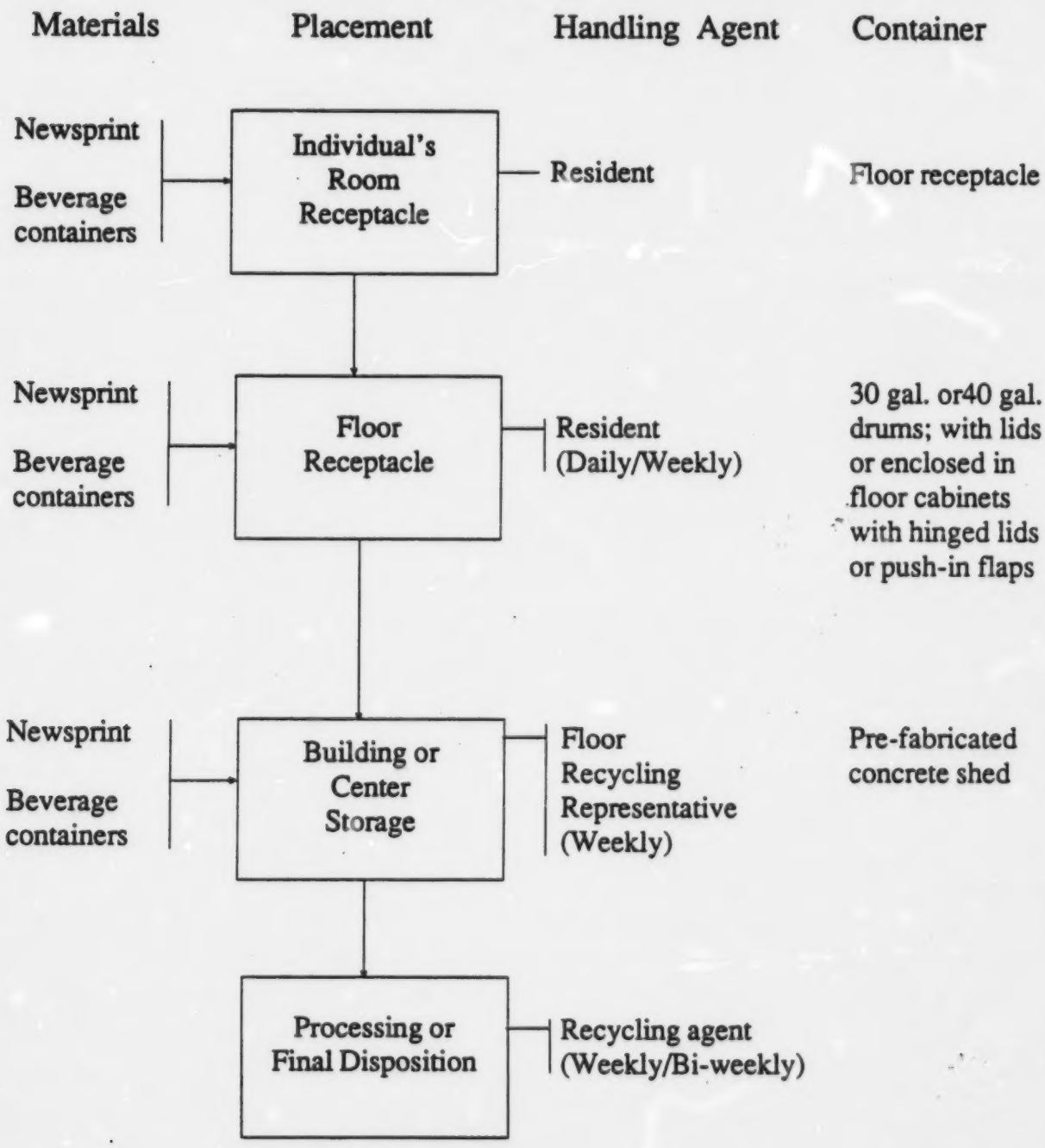
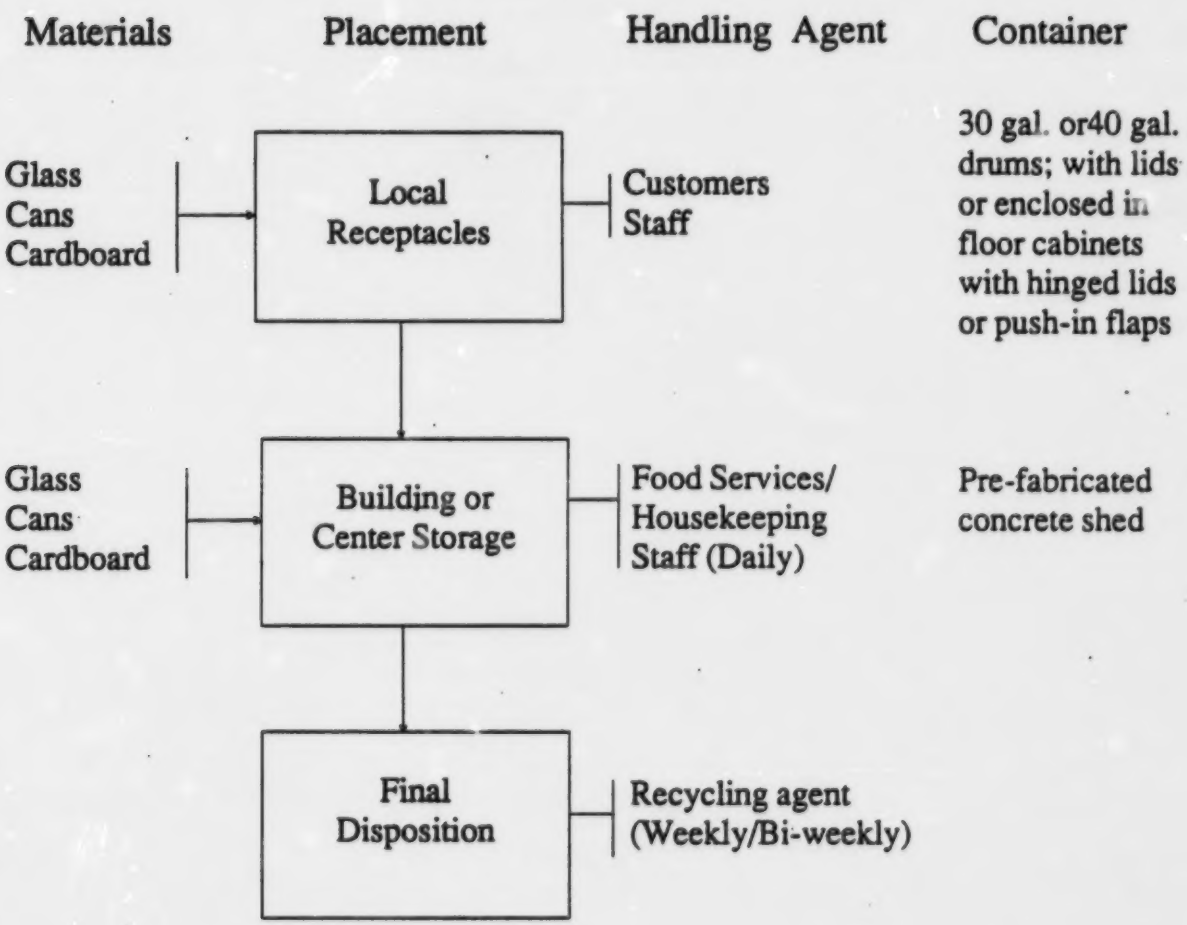


Figure 4

Food Services
Recoverables Stream Flow



4.5.4 MUMC

The McMaster University Medical Center is recognized as a separate sector because it occupies a single, but large, structure on campus. However, the Center also contains some sectors similar to those present in the University component. In addition, the medical operations of MUMC generate a large volume of various wastes, some of which require specialized handling procedures.

In general, the handling and stream flows designated in the foregoing sections on the sectors for Academic/Administration Offices and Food Services, will apply to the similar areas of MUMC.

4.5.5 General Commentary

a) Most buildings discard skids on a more or less regular basis; MUMC in particular accumulates large quantities in one location because of the central shipping/receiving area. In general, skids are placed outside the receiving building by staff of the department receiving the delivered goods. This arrangement should not be changed. At present, the accumulated skids are collected from campus buildings periodically by Grounds Services staff. If an outside agency is permitted to collect these skids regularly for removal and re-use, it may be possible to remove this task from the responsibility of Ground Services, thereby freeing time for other activities.

b) The frequency of servicing floor or wing center containers in offices and residences may vary, depending upon the specific function performed in an area, and fluctuating activities during the year.

c) In general, office and academic staff should be encouraged to take their newspapers home for removal through their residential Blue Box program. This will help prevent an unnecessary demand

on housekeeping staff, while still achieving recycling of this material.

d) In areas, or on occasions, when cardboard accumulates rapidly, it may require removal to the Storage Center buildings on a daily basis. Whenever possible, discarded cardboard boxes should be broken down by the user to facilitate storage, bundling, and handling. Depending upon the co-operation received by departmental personnel, some additional custodian workload may be created by this activity.

e) The recommended recyclables handling process assumes that all waste materials will be removed from the Storage Center buildings by the Recycling Agent(s). It is not recommended at this time that the University provide a large central storage depot, nor that the University deliver recoverables to any central storage center or a recycling agent's facility.

4.6 Recommended Staffing and Equipment

4.6.1 Staffing

(i) Waste Management Co-ordinator

It is recommended that one Waste Management Co-ordinator be hired on a 3 year contract basis, conforming to the Environmental Partners Fund subsidy period. When the recycling program is established, and the value of this position has been ascertained, the University should consider establishing a permanent job category for this task. Duties of this position may include the broad waste management function and selected environmental issues for the University and MUMC, directed through the Physical Plant Department. The total cost of maintaining this position, including provision of a suitable vehicle, is estimated to be approximately $50,000 per year. The figure includes benefits, overhead costs, and a vehicle pool allowance. Of this amount, the Environment Canada Environmental Partners Fund may subsidize up to 50%, which can reduce the net annual cost to about $25,000 for 3 years. The Cost-Benefit Analysis,

Table II, has assumed a conservative 25% subsidy for these wages. An outline of suggested Co-ordinator duties is presented in Appendix H.

One of the early priorities of the Co-ordinator will be to assist various departments to define and develop practical and effective reduction tactics, to minimize the unnecessary generation of waste. The general approach in this regard will include an evaluation of the departments' operational practices and a review of means to:

* eliminate or reduce usage of certain materials or products
* eliminate certain practices
* assess purchasing policies

ii) Custodial Workload

The submitted recycling strategy is intended to maximize use of available resources, and to avoid creating unnecessary additional workload. However, in practice, and depending upon the co-operation received from various campus sectors, some additional demands may be expected in this regard. At this time, an estimated extra workload equivalent to 2 person-days per week is considered to be a realistic projection.

TABLE VI

4.6.2 Primary Recycling Equipment

	Item	Estimated Number	Estimated Unit Cost	Estimated Total Cost
1.	Individual workstation receptacles	6,000	$10	$60,000
2.	Floor receptacles			
	- containers	500	$100	$50,000
	- cabinet enclosures	125	$200	$25,000
3.	Outdoor beverage bins	20	$150	$3,000
4.	Building storage sheds (pre-fabricated concrete)	30	$6,000	$180,000
5.	Recycling Station Signs	300	$20	$6,000
6.	Weigh scales	1	$2,000	$2,000
			TOTAL	$326,000

The use of weigh scales is considered necessary to maintain records of waste diversions. Located at the Campus Services Building, the scales would be used to establish representative average net weights for containers of recyclables. Weights would be re-established on a periodic basis. Quantities of diverted recyclables would be extrapolated by applying the average weights to the total number of bags or containers of various materials removed for recycling. This is considered to be an adequate and more suitable method than attempting to maintain actual weight records for all diverted materials. The foregoing estimates of required units are based upon

a general evaluation of campus building needs. The actual number of units placed may be somewhat greater or lesser than indicated, subject to specific circumstances in each department and building.

With respect to the Storage Shed Centers, some large buildings may require more than one, to accommodate the quantity of recyclable materials generated therein. For example, MUMC may require up to 4 units. Other smaller buildings may be able to share a single storage shed.

Because the introduction of accessory buildings is recognized as a sensitive issue, a more detailed commentary is warranted.
The recommended sheds are entirely of pre-fabricated concrete construction, including the roof. Their dimensions are about 12 feet wide, 10 feet long, and 7 feet high. Exterior walls are an architectural pebble finish, and each building is fitted with locking steel double entry doors. These units are delivered by flat bed truck ready to place upon a prepared stone base. No further site work is necessary. Although the initial cost of these buildings is somewhat higher than the installed cost of metal or wood garden sheds, and perhaps slightly higher than the cost of on-site constructed masonry buildings, the pre-fabricated structures are recommended. They offer quick and simple installation and a high degree of durability. Also, their exterior finish is not expected to conflict with the existing building forms on campus.

The storage sheds should be placed against existing buildings in an area where they are conveniently reached by personnel removing containers of recyclables from within buildings; they should also be relatively accessible from nearby roadways or paths which can be used by vehicles (trucks or carts) collecting materials from the sheds.

Where placement of the sheds occurs in an area where their presence may be detracting, the use of plantings will provide effective visual screening. The recommended sheds will have far less visual impact

than the waste bins which are now kept in exposed locations. In selecting these sheds for recyclables storage, a number of options were examined for this purpose. Excess accumulation of recyclables on office and residence floors, stairwells, or kitchen areas is not acceptable because of the obstructions, fire hazard, and sanitary concerns. Removal to basement areas does not overcome these concerns, and adds significantly to handling demands, as these materials must be retrieved and placed outdoors for collection. Without storage sheds, on the designated collection day large plastic bags of recoverables would be placed outside of buildings for pick-up. These are considered unsightly even for short periods, as most collection areas are in high-visibility zones. If a collection is missed or delayed, the bags remain in view until disposed of, or removed at a later date. The image projected by exposed bags of recyclables is not considered to be consistent with the manner in which McMaster University wishes to portray itself.

The enclosed sheds provide a relatively inconspicuous, safe, and durable option for the efficient and tidy storage and handling of recyclables. Also, the storage of bundled cardboard is achieved economically because container bins are not required. Finally, if collections are missed because of inclement weather or equipment problems, this does not create immediate difficulties because the materials are enclosed and secure for removal at a convenient later date.

Also, as noted previously in Section 4.4.3, storage and access requirements, specified by recycling agents, are becoming more stringent as market conditions become more restrictive.

MUMC has a central shipping/receiving area where some storage may be possible. However, this area tends to become congested with vehicles and the regular waste storage and handling operation. Therefore, the placement of 3 or 4 outside sheds is recommended for the Center.

The placement of attractive framed recycling logo signs is recommended at all floor recycling centers and outdoor bin locations. This will promote the program and identify container centers for persons wishing to deposit recyclables. Outdoor bins for beverage containers and newsprint should be attractive, visible, and near pedestrian main traffic routes for easy access and use.

McMaster University and MUMC have been evaluating the possible purchase of certain items of equipment for waste management and recycling purposes. These are reviewed in the following Section 4.6.3 Secondary Equipment.

4.6.3 Secondary Equipment

a) Cardboard Baler

McMaster University received a proposal for a cardboard baler in June, 1989. A review of the figures presented in the proposal indicates that the estimates for cardboard recovery, stated in the submission, are high. The proposal indicates that approximately 39.5 tons/week, or 2080 tons/year are available from the University and MUMC. This is an excessive estimate, since the total annual waste tonnage is 2460 tons (Sept. 88 - Aug. 89). It is likely that the total cardboard is, at most, only 20% of the total waste, or about 500 tons/year. The net annual saving available by recycling unbaled cardboard is about equal to that for baled product; therefore, the purchase of a cardboard baler should only be considered if handling and storage difficulties warrant its installation. If the cardboard can be bundled and handled adequately in its loose form, the baler is not required. Also, most of the saving (80%) associated with cardboard recycling is associated with the avoided disposal fee ($110/tonne in January/89) rather than the sale of the cardboard ($25 to $40/ton).

b) Confidential Paper Shredder

The University currently disposes of approximately 60 tons per year of confidential fine paper by incineration at SWARU. In a Physical Plant report dated March, 1989, a number of options were examined to reduce the annual cost of this service, which is now about $19,000/year. The most desirable option noted in the report appears to be the provision of small office shredders in areas generating high volumes of confidential documents. The annual operating and capitalization costs of this measure appear to be about $6,900/year. This figure is based upon an initial purchase price of $19,826 for shredders, with 10% carrying charges over 5 years ($4,956), amortization over a 5 year operating life, and $9,915 maintenance costs over 5 years. The average annual cost computed on this basis will be about:

($19,825 + $4,956 + $9,915) ÷ 5 = $6,939.

The actual average annual cost may be 25% higher because maintenance expenses will increase as the equipment ages.

The benefit of assigning the user groups their own shredders is to reduce the demand on the Physical Plant Department to collect and dispose of this paper. Although the amount of paper designated as "confidential" may be reduced by this measure, it is unlikely that the total fine office waste stream will diminish. However, after shredding, the paper will be suitable for recycling without compromising confidentiality. As a method of assisting the University recycling program, the shredders may be eligible for a capital grant of 25% to 50% from either the Ministry of the Environment or Environment Canada.

In this same regard, MUMC is evaluating the purchase of a new refuse shredder and compaction system that will also have the capability to shred and compact fine office paper for recycling. The estimated total value of the system is about $125,000, including container bins. If the manufacturer can guarantee that the units can shred

paper adequately, this may be a viable joint option for the University and MUMC to consider. A specific problem to be resolved concerns the potential contamination of recoverable paper. If the units can be thoroughly washed and cleansed before shredding recyclable paper, they will be suitable for this application. There is a possibility that even thorough cleaning may not remove all potential contaminants, which may be dislodged when the paper is processed. This may be remedied by first processing a quantity of relatively clean paper waste (paper towel waste) prior to introducing the fine paper. Dedicated bins for fine paper would also be required. This equipment could be eligible for a 25% to 50% subsidy by the Province or Environment Canada, if deemed eligible.

It is important to note that fine paper shredding by McMaster must incorporate strict quality control to ensure that unacceptable contaminants are excluded. If any contaminants (wax paper, carbon paper, adhesives, refuse, plastic, cellophane etc.) are present in the shredded material, the entire batch may be rejected and will require disposal. If the level of control available is questionable, it may be more practical to arrange for a recycling agent to collect the unshredded fine paper. The agent will then sort and shred the material to market standards. The issue of confidentiality must be addressed in the latter arrangement.

4.7 Program Management Structure

The recommended structure for management of the recycling program entails the participation of different groups and levels of administration from the University and MUMC. In general, the University/MUMC administration will develop and issue policies related to the recycling program. This direction will be conveyed to a Campus Recycling Committee on which will sit a representative(s) from:

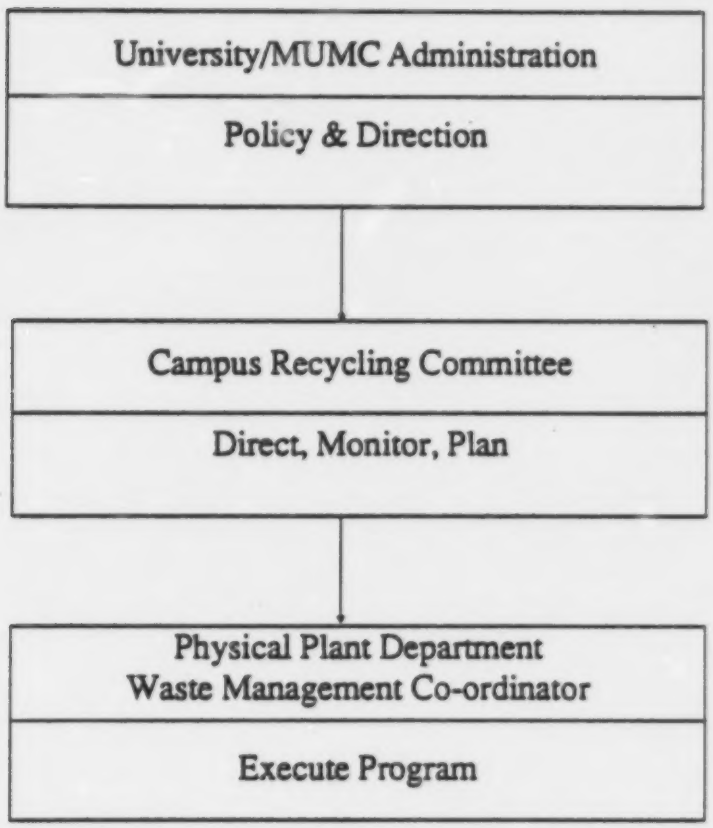
* Administration
* Faculties
* MUMC
* MSU
* McMaster Recycling Initiative
* Physical Plant Department (Waste Management Co-ordinator)

In response to direction and policy from the administration member, the Recycling Committee will direct, monitor and plan the ongoing recycling program, which will be executed through Physical Plant. As a physical operating entity, and because of its experience and current responsibility for waste management activities on campus, the Physical Plant Department is considered to be the most suitable agent for the recycling program. The Recycling Committee should also consider assigning one of its members to the Regional Waste Management Co-ordinating Committee.

In addition to its position on the Campus Recycling committee, the McMaster Recycling Initiative should be actively involved in developing and delivering education/information programs to the student body. The presence of a dedicated permanent staff Waste Management Co-ordinator for the recycling program will ensure continuity throughout the calendar year, and in consecutive years. It is not intended for any of the members of the campus community or Recycling Committee members (including McMaster Recycling Initiative) to perform sorting of containers and other recyclables as was done in the past. With an appropriate recycling/collection agent in place, which has necessary sorting/separation facilities, the campus participants can concentrate their time and efforts on higher order and more productive activities related to recycling. Figure 5 illustrates a proposed project management structure.

Figure 5

Proposed
Project Management Structure



5.0 PROJECT INTRODUCTION

5.1 General

McMaster University commissioned PAL-TECH ENGINEERING to develop a comprehensive and effective recycling program for the university community, and pursue subsidy funding that may be available from the Ministry of the Environment and OMMRI for the capital works and activities associated with this project.

The joint objectives of a recycling strategy would be to:

a) reduce overall waste generation
b) divert recoverable materials from waste, to re-use and recycling
c) reduce disposal quantities and costs

5.2 Method

The activities conducted in the course of this project included:

a) Examination of the significant waste generator centers, and interviews with the individuals involved with, or responsible for, the operations of the centers. These areas and people included:

* Physical Plant Department: Rick Crook
* Physical Plant Department: John Dawson
* Waste Collection Truck driver: Larry Greenhall
* McMaster Student Recycling Initiative: Kathleen Mogan, Mark Jeffrey
* McMaster Recycling Committee: Dr. Brian Baetz
* Food Services: Raymond Lee
* Faculty Club: Leanne Pepper
* Computer Information Systems: Pat O'Day

* Printing Shop: Gary Kitchen
* McMaster Courier: Vic MacBournie
* Silhouette: David Beer
* MSU Graphics: Sandra Giordano
* Residences: Ron Coyne, Caroline Ehrat, Paul Frazer
* McMaster University Medical Center: Karen Stone, Joan Aird

In addition, information on recycling activities being planned or conducted at other educational institutions was obtained through available reports, or interviews. Specific programs examined included:

* University of Western Ontario
* Guelph University
* University of Toronto
* University of Alberta
* Ontario STAR Program (Student Action for Recycling-Primary and Secondary Schools)

Further communications, for additional information, were conducted with:

* Hamilton-Wentworth Department of Engineering
* Hamilton-Wentworth Third Sector Recycling
* Recycling Council of Ontario
* Recycling Advisory Council
* Ministry of the Environment
* OMMRI (Ontario Multi Materials Recycling Inc.)
* Recycling market agencies

b) Evaluation of the waste stream characterization and volumes, by visual examination supported with waste tonnage data.

c) Evaluation of sources, characteristics, and volume of materials that can and should be recycled.

d) Reviewing and describing trends and projections in specific recyclable materials marketability.

e) Defining the most effective methods of collecting, consolidating, processing, and removing the recycled materials. The general type and location of receiving and storage receptacles are described.

f) Defining the allocation of recycling-related activities to permanent staff and/or volunteer or student workers, as appropriate.

g) Establishing an estimated cost/benefit comparison of the recommended recycling strategy.

h) Providing general specifications for capital and operating equipment, cost estimates, and conceptual layout.

i) Assisting the University in pursuing available funding for project implementation.

6.0 BACKGROUND CAMPUS CHARACTERISTICS

6.1 Physical Features

McMaster University constitutes a significant community forming part of the City of Hamilton, and the Region of Hamilton-Wentworth. A total of 43 buildings, plus the substantive McMaster University Medical Center, occupy a total campus area of approximately 300 acres. Three new buildings will be added to this total by 1992.

6.2 Campus Population

The campus community consists of a highly diversified population of students, faculty, office staff, trades personnel, hospital patients, medical personnel, and various support staff. A search of information in several departments resulted in the following summary of the campus population:

TABLE VII
Campus Population

a) Students		
Full time undergraduates	11,100	
Full time graduates	1,440	
Part time undergraduates	3,300	
Part time graduates	650	
Total students		16,490
b) University staff		
Full time faculty	1,000	
Office Staff (full and part time)	1,900	
Trades/maintenance	500	
Total university staff		3,400
c) Residences		2,400
d) Medical Center		
Hospital beds	456	
Office staff and physicians	784	
Health care staff	2,030	
Total Medical Center		3,270
Total potential generation population (a) + (b) + (d)		23,160

The noted figures are considered to be reasonably accurate and representative of the overall campus population. However, some minor variances may be expected, as the exact distributions and counts could not be guaranteed by the several departments contacted to compile this information.

6.3 Waste Generation Sectors

The general University community is comprised of many diversified and relatively autonomous sectors distributed throughout the campus. These sectors, which produce the University's waste stream, are further distributed into smaller groups occupying segregated buildings around the campus. For this reason, a standard and simple recycling program common to all campus and building areas cannot be developed and implemented readily. In order to establish a manageable rationale for such a system, four discreet waste generator sectors were defined. These are:

a) Academic/Administration
b) Residences
c) Food Services
d) McMaster University Medical Center (MUMC)

These sectors were established to consolidate common functional characteristics, and waste generation patterns, which are specific to each area of activity. In this regard, the Medical Center is unique. Although it incorporates functions from the noted groups (a) and (c), the Center channels most, or all, of its waste to a central location for processing and removal. Because of this centralized function, the Medical Center is treated as a separate and different generator sector.

7.0 WASTE STREAM AND GENERATORS INFORMATION

7.1 Waste Collection

At the beginning of this project, the author accompanied the waste collection truck and driver on a typical daily campus collection route. The purpose of this was to examine the quantities, conditions, and any notable characteristics of the garbage at each collection point. In addition, the wastes were examined upon discharge at the Regional Transfer Station in Dundas. Larry Greenhall, the collection driver, provided a detailed commentary of the typical range and volumes of waste normally encountered at each pick-up point.

The normal daily route, run 6 days a week, entails approximately 150 stops, of which several have more than one bin to dump. A number of stops do not involve bins, but require collection of several garbage bags of waste left curbside outside of some residences and office areas. The full route is usually serviced twice a day, and bins at food services areas (Commons, MUMC) are collected up to three times a day.

Many of the bins observed, which are of various sizes ranging from about 3 cubic yards to 10 cubic yards, have no lids to enclose the contents completely. Because the wastes are collected so frequently, the use of closing lids is not considered essential.

Some bins are partially filled when collected, while others are overflowing and wastes are piled around them. The overloaded bins are typically found at buildings containing large populations of staff and students.

Most of the bins are in areas of relatively restricted access, requiring a careful level of manoeuvring with the collection truck for access to, and loading of, these units. Very few of the bins are

situated in well-screened or enclosed areas, although they are usually in locations where they are out of direct public view. However, several bins are in highly visible areas and present an unattractive appearance and emanate unpleasant odours in warm weather. It is suggested that these latter bins should be enclosed, and flushed out regularly. Wooden fence enclosures are in place around certain waste bins, and this measure effectively serves to hide the containers from sight. Some additional time and effort is required for the collection driver to service these units, but the improved appearance of the storage area is a definite benefit.

On the collection route, the most apparent recoverable material in the waste was corrugated cardboard. This material was very prevalent at Togo Salmon Hall, the Commons (from Food Services), and MUMC. At a number of locations, it was observed that large scrap items, usually metal, but sometimes wood, were placed near the waste bin. These oversized materials are generally too heavy or too large to be placed in the bin, and remain outdoors until the staff from Grounds Services can be dispatched for a special pick-up.

Wooden pallets were found to be prevalent at the collection areas for Chester New Hall, and MUMC.

Wastes collected at residence locations consist primarily of glass bottles, with a quantity of housekeeping refuse.

Several bags of trash are collected in the University Hall archway. Because this is a high-traffic area, consideration should be given to placing this waste in a less conspicuous area.

A cursory examination of the load of waste discharged on the Transfer Station floor revealed the following information:

- approximately 25% of the volume dumped consisted of clean cardboard
- some laboratory glassware was evident
- random batches of cardboard and office paper were seen
- few glass or metal beverage containers were in evidence, suggesting that the limited campus recycling program in place currently is having some effect on diverting these materials from the waste stream
- no hazardous or liquid waste was visible

It can be expected that the quantities and characteristics of the campus solid waste stream will vary throughout the year, and even during the week. However, for purposes of a preliminary evaluation of the University's waste stream, this route and waste review provided a manageable degree of information.

7.2 Waste Quantities and Characteristics

The total solid wastes delivered to the Regional Municipality of Hamilton-Wentworth Dundas Transfer Station between September 1988 and August 1989 were considered to be representative in terms of waste generation for the university. A total of 2,237 tonnes of solid waste was generated during that period. This constitutes about 1.4% of the total waste received by the Region.

The following is an estimate of McMaster University's waste stream composition based on a comparison of the estimated Ontario Municipal Solid Waste stream, University of Alberta Waste Characterization study, and average generation factors for hospitals and universities for specific materials (as determined by Resource Integration Systems for the Recycling Advisory Committee and Ontario Multi Materials Recycling Inc. (OMMRI)).

TABLE VIII

Estimated University Waste Stream Composition

	% by Wt.	TPY*
Paper Products		
Newspaper	12	268
Fine Paper	22	492
OCC**	18	403
Other	3	67
Total Paper Products	55	1,230
Yard Waste	12	268
Food Waste	13	291
Wood	2	45
Plastics/Rubber	6	134
Glass	4	90
Cans	2	45
Other Metals	1	22
Misc.	5	112
		2,237

* Tonnes per year
** Old Corrugated Cardboard

7.2.1 McMaster Computer Information Systems

This department generates substantial amounts of computer printout (CPO) paper, spending about $200,000 per year on this product. Approximately 2/3 of the CPO is purchased as recycled paper, which resembles high-quality newsprint, as opposed to the fine office grade paper normally used for CPO. The recycled CPO is used mainly for printing at any of 5 satellite locations and numerous PC labs used primarily for academic activities by students. This paper is for work which is usually disposed of quickly. Most of these print-outs are 10 to 15 pages in length. In general, this paper could be recovered for newsprint recycling, but it is usually too scattered around campus to permit ready collection; however, the potential for recovery does exist.

Recycled CPO is also used for business activities in the systems department. These printouts are about 50 to 100 pages in length and generally remain in the offices where they can be controlled for recovery. Every 2 weeks, Third Sector Recycling collects between 25 and 50 cartons of accumulated used newsprint CPO. This material is stored in a central area on the second floor hallway in the vicinity of the programmers.

High-quality fine grade CPO is used for administrative systems forms. These reports are usually delivered to various departments by Systems staff, who also collect the CPO high-quality discards and return them to the second floor storage area for pick-up by Third Sector. No revenue is received by the University for this paper. Effective December, 1989, Third Sector is only able to collect paper at ground floor level, either outdoors, or near a convenient exterior door.

In total, about 800 lbs of CPO per week, or 20 tons per year, are usually diverted from disposal through the Systems recovery program.

Confidential papers are handled by Grounds Services staff for secure disposal.

The respective volumes of CPO used are about 2/3 recycled stock, and 1/3 fine paper stock. Most of the fine paper stock is directed for confidential document disposal after use.

A committee was formed recently to develop measures that will reduce the amount of waste paper generated by print-out activities. The basic premise of this approach considers the use of video terminals to transmit reports and mail, instead of hard paper copies.

7.2.2 Food Services

University food service operations are divided into two main categories; Board Plan, and Cash Plan. The Board Plan provides service to individuals who are on a standard pre-paid meal plan, and is operated in the Commons kitchen, the largest campus food operation, and the Refectory. The Cash Plan refers to direct purchases at the A. Bournes, Togo Salmon, and Kenneth Taylor cafeterias. Approximately 2,050 people take part in the Board Plan, while a population of about 9,000 faculty, staff, and students use the cash operation.

Reusable cutlery and china are supplied for the Board Plan, while disposable plastic, paper, and foam wares are used in the Cash Operations. In order to minimize waste generation, it would be preferable to use non-disposables for food operations. Also, the use of disposables incurs a cost approximately three times greater than that associated with non-disposable wares. However, there are two principal reasons that disposables are used in the cash cafeterias. First, the campus population has increased significantly, while kitchen washing facilities have not. In order to accommodate all non-disposable kitchen ware in the cash operations, additional space and new, larger washing equipment would be required. The capital costs of these measures are estimated to

be about $200,000 for each requirement, for a total of $400,000. The second reason for the use of disposables is pilferage. It is difficult to control cash operations, and substantial losses have been incurred in the past; the high cost of replacing durable cafeteria ware was unacceptable.

The principal recoverable materials available from the preparation side of Food Service operations are:

- small quantities of glass juice containers
- large quantities of cardboard

It was stated that these could be readily separated by kitchen staff if collection and removal for recycling is instituted.

It is estimated that about 500 lbs/day or 90 tons/year of food wastes are generated in the kitchens. This waste could be considered for separate collection directed to composting, if the Region establishes a planned composting facility. Alternately, the Ministry of Agriculture may provide information on animal feed outlets for food scraps.

On the customer side of the cafeterias, the most predominant recoverables are glass and metal (mostly aluminum) beverage containers. These are now being collected by the Student Recycling Initiative.

7.2.3 Faculty Club

This location has very good potential for the recovery of glass and metal containers, and cardboard. The Faculty Club has participated in the Recycling Initiative activities, but has identified problems related to container handling, collection service, and storage, as obstacles to continuing and effective participation. Specific reported difficulties relate to irregular or missed collection of recoverables.

7.2.4 Printing Shop

This facility uses cartons, in which supplies are received, for packaging of outgoing work. Usually, extra cartons are needed for shipments out, and these are purchased used or from overrun surplus stocks.

Fine paper scrap is accumulated in a large bin which was usually removed regularly by an agent who delivered it to Mills Fibres for recycling. A list of acceptable paper for the bin is posted on the wall nearby.

No revenue is received for the scrap paper, and quantity estimates were not available.

Effective December, 1989, the collection agent suspended its service because of inadequate quantities and deficient source sorting. Collection may be available again if minimum quantities of one tonne are accumulated for pick-up, and if more consistent source separation (eg. no garbage, carbon paper, FAX paper, etc.) is observed. The Printing Shop has explored the availability of recycled paper, but found that it is about twice the price of paper made from virgin fibre. DOMTAR has recently introduced a 100% recycled paper made from post-consumer waste (many recycled papers are made from new ends and cuttings collected in the paper factory). The appearance of the DOMTAR paper does not approach that of good-quality office bond, although U.S. recycled paper sources have been marketing products that are almost identical to virgin fibre paper. The cost of the recycled DOMTAR bond is $11/1000, as opposed to $8/1000 for new standard bond.

As an added service, the Printing Shop will recycle University office paper used on one side only, by cutting down the sheets and padding them into small notepaper blocks. Because of difficulties encountered with paper clips and staples in regular office scrap

(which damages the cutter blades) most of the padding is performed on the print shop's own overruns.

7.2.5 The Silhouette

This campus student paper has a circulation of approximately 13,000, and generally, this is the number of issues printed every week. As the printing is done by an outside agency, there are overruns printed sometimes. On occasion, there are leftover bundles of the paper remaining in certain locations on campus. It is believed that fewer surplus papers will remain if their distribution is more consistent with areas of demand, and the Silhouette staff are reviewing this matter.

The general practice with surplus newspapers is to place them in recycling bins on the Thursday following issue; however, sometimes the leftover bundles are placed in garbage bins instead.

The Silhouette office generates little cardboard, and a minor amount of fine paper. This group has stated a firm desire to participate actively in a comprehensive campus recycling program, and provide promotion in its newspaper. One of the first items of information for the reading public may involve a notice recommending that the Silhouette should be taken home, or into residences, by readers, for Blue Box collection. This would constitute a significant improvement over having used copies strewn about the campus grounds and buildings. Appendix I provides some sample notices for reference.

7.2.6 MSU Graphics

This student agency is operating a small, but active, internal recycling program for fine paper and cardboard. Approximately 30 lbs of scrap photocopy paper is generated every 2 weeks for recovery. Usually, this scrap is used for note writing on the unused side before disposal for recycling.

7.2.7 The Courier

This office has the potential and desire to recycle fine office paper. The newspaper circulation, approximately 10,000, is sometimes subject to overruns by the printer; usually in the order of 500 extra copies. General practice is to have surplus papers collected by Third Sector Recycling.

Both the Courier and the Silhouette would support the use of recycled newsprint for their products, if it was available at a relatively competitive price.

The Courier would also welcome the opportunity to promote campus recycling and waste reduction, by publishing articles in this regard.

7.2.8 Grounds Services

This department composts approximately 14 tons/year of collected leaves in the west campus compound. Donated wood chips, made from waste prunings, are used for ground cover and as mulch in appropriate areas.

Approximately 2 tons/year of cut tree sections are recovered by staff for home fireplace use.

About 1300 wooden pallets per year are collected by the Grounds Services staff; it is estimated that 600 of these are obtained at MUMC. Out of a total of about 26 tons/year of skids, nearly 1/2 of these, or 13 tons, are diverted for re-use by truckers, or removed for fireplace use by staff. However, it was stated that the noted removal activities are not very regular or reliable, resulting in the undesirable accumulation of pallets at certain times of the year.

7.2.9 Student Residences

The 9 residences have recently established a well-structured recycling program. The principal recoverables are metal beverage containers and newsprint.

Student population in the residences varies from a low of 69 to a high of 500; the average population is 250 students per residence building.

The most significant difficulty with residence programs, as with other buildings, is the storage of recovered materials. Generally, warm weather causes the contents of beverage containers to become rancid in less than one week; also, vermin may breed in the beverage bins. The solution to this problem could include more frequent removal of collected materials, or use of containers with securely closing lids.

7.2.10 McMaster University Medical Center

MUMC generates an estimated 66 tons/month (or 800 tons/yr.) of waste, or about 1/3 of the total quantity generated on campus. Substantial amounts of high grade office paper, and CPO are disposed of regularly. Because much of this paper is classified as confidential documents, it is directed to secure disposal; a minor amount of fine office paper is collected by Third Sector.

MUMC uses disposable kitchenware in the cash cafeteria areas, and durable ware in the patients' rooms, in order to minimize expenses due to losses of utensils and china in the public areas.

Although relatively few used glass and metal containers are generated in the MUMC food preparation areas (most of the actual meal preparation is done at other locations), those that are discarded may be kept apart from the general garbage stream, for recycling. The

student Recycling Initiative program to collect beverage containers (mostly metal) from the cafeteria areas has been functioning very erratically. Difficulties ensue when the dedicated beverage container bins become full, and are not serviced; or when bags of beverage containers are set aside for pick-up but are not collected within a reasonable period of time; they are then discarded in the garbage bin. The MUMC administration appears to be very interested in pursuing an effective recycling program, and the noted problems can be overcome with proper communications and certain remedial measures.

The MUMC food services section generates about 30 to 40 cardboard boxes per day; most of these may be recycled. Based upon an examination of the loading dock garbage bin, it is apparent that significant quantities of cardboard wastes are also available from other areas of the Medical Center.

The food services division of the Medical Center serves about 1.3 million patrons annually.

8.0 MATERIALS AND MARKETS

Materials which are being considered for recycling at McMaster are newspapers, fine paper, glass, steel and aluminum beverage containers, and old corrugated cardboard (OCC). The following is an overview of the current market prices (FOB destination - supplier of materials pays shipping charges) and the market specifications for the materials.

MATERIALS

8.1 Newspaper

Ontario's Blue Box recycling program has created a surplus supply of newspaper which has driven down the market price for this material. The market price for newspaper free from contaminants is 0 - $5/ton. The market for this material is expected to improve when Atlantic Packaging opens a paper mill. The mill will be capable of using 100% reduced fibre, and is expected to open sometime in 1990.

8.2 Old Corrugated Cardboard (OCC)

The market for OCC, similar to newspaper, is currently very poor. Loose cardboard, contaminant free, currently obtains a price between $0 -$10/ton. Cardboard which is waxed or plasticized can not be recycled. Again, the market for this material is expected to recover once the Atlantic Packaging facility goes into operation.

8.3 Fine Paper

The fine paper market has remained relatively stable compared to that for newspaper and corrugated cardboard. Fine paper is a general term for a variety of high quality papers. There are three basic grades or classifications of paper generated in offices:

1) computer printout - continuous feed paper used in computer printers

2) white ledger - white only bond quality writing, typing and photocopy paper

3) coloured ledger - coloured, including white bond quality writing and photocopy paper

Office paper is normally a mixture of grades of paper and requires sorting in order to receive premium prices per tonne.

A fine paper recycling program is very sensitive to contaminants in terms of:

- other grades of paper i.e. newspaper, cardboard, brown paper bags, paper towel
- glues, waxes, coatings and bindings on paper which is not water soluble; i.e. carbon paper, gummed or adhesive labels, waxed or plasticized papers, envelopes with windows, sticky notes, chemically treated paper
- other materials which are not paper, plastic binders, excessive amounts of paper clips, string and elastic

An effective promotion and education program is essential for the success of a fine paper recycling program.

Prices as of October 89 for this product are:

Computer printout - $80 - $170/ton loose
White ledger - $55 - $120
Coloured ledger - $40 - $120

Pick-up is normally available for quantities of one ton or more.

8.4 Metal

Steel and Aluminum Beverage Containers

The markets for scrap metals continue to remain stable and the prices of steel and aluminum can scrap are tied to this market. Steel can scrap has a market value of $70/ton and aluminum can scrap brings $1,000/ton. Beverage containers are currently a mixture of steel and aluminum and must be separated from each other to be of value to an

end market. The cost of separating these materials and the revenue generated by quantities of materials collected at McMaster would not offset the cost of separating these materials, as the purchase of a magnetic separator would be required, and a significant amount of labour is needed to operate the equipment.

8.5 Glass

Consumers glass is the major purchaser of container glass in Ontario and has indicated that there is a strong long term market for good quality, colour sorted materials.

Most recycling programs in Ontario have not been colour sorting glass containers and this has led to an oversupply of this material. The current market price for mixed coloured glass is $10-$15 per ton.

Currently, technology has not been developed to effectively colour sort glass and this must be done manually.

8.6 Recommendations

The infrastructure for collection and processing of glass, metal cans and newspaper (standard Blue Box materials) has been established in Hamilton-Wentworth Region.

Quantities of these materials which will be generated by the university, although significant, do not warrant the purchase of processing equipment.

It is recommended that these materials be centralized in accessible locations and collected by the local municipal recycling contractor.

The university may incur minor costs associated with the movement of the materials to the central locations, however these costs will be offset by the cost savings resulting from the avoided tipping fee.

The municipal recycling program does not currently handle fine paper and cardboard although it may do so in the future.

The university should therefore secure markets independently for the sale of fine paper and corrugated cardboard.

9.0 SUPPLEMENTARY CONSIDERATIONS

9.1 Promotion/Education

The regular promotion of the University's recycling program is essential to its success, particularly due to the "temporary" student population.

Students will need to be reminded how the program works on a regular basis through brochures, posters, advertisements in the university's newspaper and on the recycling receptacles themselves.

The program's success is dependent upon an individual's participation, their knowledge of what is required of themselves, and a willingness to co-operate. Thus, participants should be kept informed as to what, how, and where materials can be recycled. Promotion also assists in communicating the success of the program. Information about the success of the program will help them consider that their efforts have some meaning and encourage their continued participation. Promotion also allows the communication of problems that may arise which require a change or improvement in recycling habits.

Faculty and students are two distinctly different target groups and the promotion of the program must also be treated in this manner.

Promotion for staff can be achieved through memorandums as required to each individual staff member. Faculty and support staff should be encouraged to take a leadership role in promoting the program to students. Their permanency at the university could be valuable in lending stability and continuity to the program.

Promotion to students is more difficult due to their temporary status and movement about campus. Every effort should be made to reach students on an individual basis at the beginning of, and during, the school year.

Brochures describing the program and how students participate should be distributed to each student at the beginning of the school year, perhaps during the registration process.

The McMaster Students Union produces calenders and appointment books/diaries. Ads could be placed in these and similar publications to serve as reminders.

Posters which remain in place in cafeterias, lounges and study areas year round would also serve as regular reminders, along with the Silhouette as a valuable promotional tool.

Promotion in residences can be easily achieved through the assistance of residence executives and floor representatives.

Additionally, receptacles for recyclable materials should be well identified and signed, which will also serve to promote and remind.

Promotional materials should clearly and concisely describe the program to students. Although some promotional materials may contain detailed information, brief promotional materials are likely to be more effective as students are typically inundated with reading materials and make efforts to minimize the amount of data which they must process.

Environment Ontario offers up to 50% subsidy for promotional activities; creative materials, such as educational pamphlets, are eligible for up to 100% funding, to a maximum of $25,000 per project.

Environment Canada's Environmental Partner's Fund may subsidize 50% of the entire recycling program, to a maximum of $200,000 assistance over 3 years.

9.2 Purchasing/Procurement Policies

The process of recycling is a closed loop cycle of materials. Goods are manufactured using raw materials; the product is used and serves its useful life; the waste material is collected and used to produce another manufactured good.

The recycling concept has flourished in the 1980's, and effective methods of collecting several products which have served their useful life have been established. Unfortunately, as discussed earlier, the markets for several of these materials have become saturated. The university can play a role in closing the recycling loop and stimulating these markets by requesting and purchasing products which contain recycled materials, particularly post consumer recycled materials.

Various levels of government are reviewing their purchasing policies and tender specifications to make expanded use of products which contain recycled materials. McMaster could similarly review its policies and tender specifications. There is some concern in evaluating products with recycled content to ensure that the products do in fact contain recycled materials or are environmentally friendly. Several major municipalities, including the Region of Hamilton-Wentworth, are contributing to a study that is being carried out by M. M. Dillon of Toronto to provide Purchasing Guidelines for products containing post-consumer waste and/or products which are environmentally friendly.

Additionally, the Federal Government-Environment Canada has established the Environmental Choice Program for consumer products. Under the program, products can be tested and approved as environmentally sound products. The product can then be identified by the "Ecologo", three intertwined doves in the shape of a maple leaf. The program involves establishing broad product categories then establishing guidelines for each category. Products are tested

against the guidelines before receiving approval to bear the Ecologo. Some of the categories which have been studied under the program are plastics, construction material made from cellulose fibre, and re-refined lubricating oil.

Another resource is the "Recycled Products Guide", published by the American Recycling Market Inc. This is a quarterly listing of companies across North America (Including Ontario) who sell products which are manufactured with recycled material content. The guide is available through Recoup Publishing Ltd. of Ottawa; Telephone (613) 448-2383.

9.3 CFC

The use of CFCs (chlorinated fluoro-carbons) in the manufacture of aerosol products and rigid foam packaging, including styrofoam cups, was banned by the Ministry of Environment as of July 1, 1989 under the Environmental Protection Act.

Thus, CFCs are no longer a concern with respect to these materials. The remaining problem lies in the fact that styrofoam containers do not break down in landfill sites. Some pilot programs are being considered by manufacturers to collect and recycle styrofoam cups, and these may be pursued by contacting the MOE in early 1990.

CFCs continue to be used in the manufacture of other products such as insulation and flexible foam furniture as well as a coolant in air conditioners and coolers. A complete phase out of CFCs in Ontario is scheduled to be achieved by the end of 1998.

The MOE is presently developing a method to facilitate the collection of CFCs from commercial air conditioners and coolers. A system is targeted to be in place by the end of 1989.

9.4 Biodegradable Plastics

The use of bags made from biodegradable plastic is a false panacea. Bags may degrade to smaller pieces of plastic, however the true benefit of this is unknown. Also this has no impact on the garbage contained inside which is the real problem. Additionally, biodegradable plastics may have a negative impact on the recycling of plastics.

9.5 Re-Refined Oil

Standards must be developed in this area to ensure that the quality and performance of re-refined oil is comparable to that of virgin oil.

9.6 Paper Products

Paper products such as writing paper, tissues and towels are likely the easiest categories in which to purchase products containing recycled fibre. The university currently purchases, and has done so for several years, computer printout paper which contains recycled fibre.

9.7 Composting

Another method of reducing wastes requiring disposal is composting. Composting is the decomposition of organic materials under controlled conditions.

McMaster campus has extensive greenery which results in significant amounts of grass clippings, leaves, etc which would be suitable for composting. Usually, leaves are the only material which is collected; grass clippings are usually left on the ground to decompose. These materials are easily composted using simple technology. If space is available on campus, a yard waste composting

program could easily be established at low cost. The finished compost can be used for landscaping purposes by the university. At the present time, Grounds Services already compost leaves.
It is important to note that composting sites are regulated by the Ministry of Environment. Proposed sites for a range of wastes must first be approved by the Ministry of Environment, although small-scale leaf composting will probably remain exempt for the foreseeable future. Food wastes from the various eating facilities on campus would also be suitable for composting, however the technology required is more complex than that for yard wastes. The quantities of these materials available would not warrant the capital investment required for a composting facility. Alternative options for food waste diversion as animal feed may be explored through the Ministry of Agriculture.

The Region of Hamilton-Wentworth is pursuing the development of a pilot composting facility at the Dundas Transfer Station. It may be viable to discuss with the Region the possibility of using the university's food wastes at the proposed facility.

9.8 Wood Pallets

Wood shipping pallets accumulate at the university when materials are delivered. Many of the pallets are currently disposed of along with the university's regular garbage; about 50% are diverted for re-use or firewood.

Pallets can be reused directly or reconditioned and used again; there are several companies in this business. A list of firms interested in pallets available in the Region of Hamilton-Wentworth is noted in Appendix F. These companies should be contacted as potential markets for pallets generated at the university.

9.9 Other Waste Reduction Activities

Some suggestions to assist in reducing the waste stream include encouraging the use of both sides of writing paper and binding scrap paper for reuse as scratch pads in offices. The scratch pads could also be sold at the McMaster Book store to promote reuse to students (while saving the students money).

Both the University of Guelph and the University of Western Ontario have established programs in conjunction with the campus food services to encourage reduction in the use of disposable cups. Plastic re-usable coffee mugs and cups are sold to students with the incentive of reduced prices for refills in the reusable mug. The sale of the mug is used as a fund raising activity.

The most desirable waste management strategy is that of Reduction, or avoidance of waste creation. Specific activities in this regard are contingent upon their acceptability within the operational requirements of the University. Because of their potential impact on the various University sectors, these measures should be developed and evaluated by the proposed Campus Recycling Committee and Waste Management Co-ordinator.

Areas of attention may include:

* purchasing policies
* communications
* pallet returns
* departmental exchanges (boxes, paper)

APPENDICES

APPENDIX A

University of Alberta
Solid Waste Composition

(Total Campus Weighted Average)

Material	% (by weight) (excluding recycled paper)	% (by weight) (including recycled paper)
Paper	57.2	63.4
Plastic	8.3	7.1
Textiles	0.4	.3
Food	9.1	7.9
Garden	3.8	3.2
Wood	2.1	1.8
Non-Combustibles	19.1	16.3

Waste Collected	20,556 lbs/day
Paper Recycled	3,496 lbs/day
Total Waste	24,052 lbs/day

APPENDIX B

Composition of Ontario MSW*

(Residential & Commercial/Industrial)

		% by weight
Paper		
Newspaper	14.4%	
Other Paper	20.6%	35%
Food Wastes		22%
Yard Wastes		15%
Plastic/Rubber/Leather		5%
Wood		3.0%
Cloth & Misc.		4.0%
Non-Combustible		
Glass	5.0%	
Cans	5.2%	
Ferrous Metal	10.5%	
Non-Ferrous Metal	0.7%	11.4%
Misc.		4.6%

* From MOE Staff

Source: Discussion Paper - "A Recycling Strategy for Ontario" - Recycling Advisory Committee, Jan., 1989.

APPENDIX C

Composition of MSW in USA

Gross Discards of MSW Materials, 1986
Source: USEPA

% (by wt.)

Paper & Paperboard	41.0
Yard Wastes	17.9
Food Wastes	7.9
Glass	8.2
Metals	8.7
Rubber, leather, textiles wood	8.1
Plastics	6.5
Misc. inorganic	1.6

APPENDIX D

Region of Hamilton-Wentworth
RECYCLING & WASTE DISPOSAL DIRECTORY

"PAPER PRODUCTS"

Check in the Yellow Pages under "Waste Paper" or

ALL-TYPE CONTAINERS 325 Leaside Avenue Stoney Creek, Ontario L8M 2M8	664-4224	Paper products (packaging) reusable cardboard cartons. Prefer cont. supply/large amounts pick-up.
ATLANTIC PACKAGING PRODUCTS LTD. 111 Progress Avenue Scarborough, Ontario M1P 2Y9	Reed Forrest (416) 298-5307	Corrugated cardboard, pay $15/ton delivered. Minimum for pick-up 25 -1000 lb bales, will pick-up loose paper.
DOMTAR RECYCLING DIVISION 66 Shorncliffe Etobicoke, Ontario	(416) 231-2525	Waste Paper. Will pick-up. May charge for mixed loads, may pay.
DUVALL BROTHERS OF BINBROOK LIMITED 2471 Guyatt Rd. East R.R. #1 Binbrook, Ontario L0R 2C0	Ken Duvall (416)-692-333	Industrial & commercial cardboard pick-up. Rent out container boxes.
GENOR SERVICES, DIV OF ENNIS-SCORY FIBRES LTD. 401 Elgin Street Brantford, Ontario	Peter Katadotis (519) 756-5264	Pick-up and drop off service for waste paper. Do not accept foil or carbon backed paper. No minimum amount.
HOTZ & SONS COMPANY 166 Ferguson Ave. N. Hamilton, Ontario L8L 4Y4	Lou Hotz (416) 527-9266	Will pick-up or receive corrugated cardboard & other paper products. Must be free of contaminants.

APPENDIX D - Continued

J.C. WASTE MANAGEMENT 615 Main Street East Milton, Ontario L9T 3J2	Fred Potash (416) 858-8008	Graders & packers of all types. Provide pick-up service. Will supply desktop containers & floor bins for collection.
MILL PAPER FIBRES LTD. 162 Ferguson St. N. Hamilton, Ontario	Dan Whaley (416) 522-6116	Will pick up large amounts of news, corrugated, office paper. Pays $40/tonne if delivered. Will accept from homeowners.
SONOCO LIMITED 33 Park Avenue East Brantford, Ontario N3T 5T5	Earl Thacker (519) 752-6591	Corrugated cardboard, newspaper pick-up millsize bales (1000-1500 lbs). Small amounts, if delivered will pay. Must be clean.
PHILIP ENVIRONMENTAL GROUP 208 Hillyard Street Hamilton, Ontario	Vic Perron (416) 577-6960	Accept corrugated cardboard and office paper. Contact for assesment.

APPENDIX E

Container Suppliers and Manufacturers

A-1 PRODUCTS CORPORATION
Box #61
Etobicoke, Ontario
M9C 4V2
(416) 626-6446
Don Holiday

BONAIR PLASTICS
#1 Valleywood Drive, Suite #300
Markham, Ontario
L3R 5L9
(416) 475-6980
Bruce Hannough

GREIF CONTAINERS INC.
300 University Avenue
Belleville, Ontario
(613) 968-6429
(416) 368-4066
Lowell Watson

IPL INC.
111 Advance Blvd.
Brampton, Ontario
L6T 4H8
(416) 791-5895
Paul Smith

Nylon Bags

DOMINION BAGS & BARREL also supply nylon bags. There are slightly cheaper (~ $1/bag) than burlap 30" x 50" size $2.75/bag based on 1,000 bags.

The price of a roll-out cart can range from $75 to over $125 depending on the type of plastic and on the process used in its manufacture.

APPENDIX E - Continued

Roll-out Cart Manufacturers

BONAIR PLASTICS
#1 Valleywood Drive, Suite #300
Markham, Ontario
L3R 5L9
(416) 475-6980
Bruce Hannough

BELCAN INDUSTRIES
24 Hayes Avenue
Guelph, Ontario
(519) 763-5221
Dan VanPoucke

GREIF CONTAINERS INC.
300 University Avenue
Belleville, Ontario
(613) 968-6429
(416) 368-4066
Lowell Watson

THE HEIL CO.
Dist. Frink Canada
777 laurel
Cambridge, Ontario
N3H 4S3
(519) 653-6234
Bob Balke

IPL INC.
111 Advance Blvd.
Brampton, Ontario
L6T 4H8
(416) 791-5895
Paul Smith

OTTO INDUSTRIES INC.
Dist. K.C.I. Mechanical Inc.
7729 Eighth Line S. Hornby, Ontario
L0P 1E0
(416) 875-4600
Jo-Anne Derrick

APPENDIX E - Continued

Household Container Manufacturers

A-1 PRODUCTS CORPORATION
Box #61
Etobicoke, Ontario
M9C 4V2
(416) 626-6446
Don Holiday

ALLIBERT INDUSTRIES LTD.
1912-A Avenue Road, Suite #3
Toronto, Ontario
M5M 4A1
(416) 783-8345
Ed Casey

BUCKHORN MATERIAL HANDLING PRODUCTS INC.
2775 Slough Street
Mississauga, Ontario
L4T 1G2
(416) 678-6545
Ray Gargarella

BUSCH-COSKERY OF CANADA INC.
1502 Gregwood Rd.
Mississauga, Ontario
L5H 2T4
(416) 274-9619
Stephen Coskery

CHAMPION PLASTIC CONTAINER INC.
36 Joseph Street
Breslau, Ontario
N0B 1M0
(519) 648-3595
(416) 346-0748
Dale Mortimer

IPL INC.
111 Advance Blvd.
Brampton, Ontario
L6T 4H8
(416) 791-5895
Paul Smith

APPENDIX E - Continued

UNIRECO INDUSTRIES INC.
58 Wild Cherry Lane
Thornhill, Ontario
(416) 889-1410
Arthur Petch

* Note: Containers (45 gal. size) used in schools have been re-designed. They are now blue (formerly black) and are available from:

GREIF CONTAINERS INC.
300 University Avenue
Belleville, Ontario
K8P 5B5
(416) 368-4066

APPENDIX F
Region of Hamilton-Wentworth
RECYCLING & WASTE DISPOSAL DIRECTORY
Wood Pallet Recyclers

COMPANY	CONTACT	TYPE OF WASTE ACCEPTED
Check the Yellow Pages Under "Pallets" Skids, or		
BOUNCERS PALLETS 2055 Leighland Road Burlington, Ontario L7R 3S9	Fred Nolan (416) 637-9513	Will pick-up clean pallets. Can do some repairs but will come and look at them first.
CHEP CANADA INC. 6360 Northwest Drive Mississauga, Ontario L4V 1J7	Brian Isard (416) 678-2263	Will pick up CHEP pallets only for reconditioning, customer can deliver.
CLARK PALLET INDUSTRIES Old 20 Road West, R.R. #1 Smithville, Ontario	Shirley Clark (416) 9547-7439	If pallets are in fairly good shape, will pick-up any amount. No min. May pay depending on condition.
GALAXY PALLETS LTD. 124 Erie Street Smithville, Ontario	Mr. McFarlane (416) 957-3392	May take used pallets. Will look at each case. Will do minor repairs. prefer large quantities but may accept small amounts.
HOTZ & SONS CO. 166 Ferguson Ave. North Hamilton, Ontario	Lou Hotz (416) 527-9266	Will pick-up or receive pallets in any amount or size of those in good shape. May pay.
MULTIPALLET LTD. 954 Middlegate Road Mississauga, Ontario L4Y 1M3	Steve Sargent, John McGill (416) 270-7901	Will pick-up wood pallets that are repairable (min. 200-300) or University can deliver. May pay. Will dispose of pallets for a fee.

APPENDIX F - Continued

SUPERIOR PALLET 7459 Trafalgar Road Milton, Ontario L0P 1E0	Rico DiLello (416) 567-0016	Pallets: 48 x 40 and 48 x 48 only. Min. pick-up 100. Will accept deliveries. Phone first for estimate. May pay.
PHILIP ENVIRONMENTAL GROUP 208 Hillyard Street Hamilton, Ontario	Vic Perron (416) 577-6960	Contact for assessment.

APPENDIX G

Storage Shed Suppliers

Hy-Grade Pre-Cast Concrete
26 Seapark Dr.
St. Catharines, Ontario
L2M 6S6

(416) 684-6584
Att: Lorne Clark

Brooklin Concrete Products
Brooklin, Ontario
Box 370
L0B 1C0

(416) 655-3311

APPENDIX H

Waste Management Co-ordinator

Proposed Tasks

General

Implement the policies of the Administration and the Campus Recycling Committee, under the direction of the Physical Plant Department.

Outline of Duties

Operate and monitor the Campus Community Recycling Strategy by:

* implementation of detailed campus recycling program
* development and implementation of waste reduction measures
* co-ordinating waste collection and recycling activities across campus
* obtain data and maintain records of waste and recyclables generation for specific campus sectors and departments
* assign disposal costs to respective departments
* assign diversion credits to respective departments
* assign and monitor equipment resources for various campus areas and departments
* co-ordinate development and delivery of information/education programs with McMaster Recycling Initiative and Campus Recycling Committee
* recommend personnel assignments, related to recycling and custodial activities, to supervisor
* monitor and record total recyclables and waste stream, and associated savings and costs
* monitor and report on difficulties and/or proposed improvements related to waste recycling and collection
* control the budget and other associated financial affairs such as subsidies related to the recycling strategy
* co-ordinate activities of recycling/collection agent
* prepare reports and subsequent measures as required
* other related duties which may be assigned by supervisor

APPENDIX I

Newspaper Recycling Advertisements

RECYCLE THIS NEWSPAPER

The Globe and Mail
Canada's National Newspaper

A better environment starts here

Old newspapers are valuable, so it's a waste to just throw them in the garbage.

Newsprint is one of the most obvious, most substantial commodities to recycle. And recycling newspapers not only preserves valuable natural resources — it also extends the useful life of our burdened landfill sites.

So, just throwing old newspapers in the garbage is a waste in more than one way.

Recycling newspapers is no great trouble — just stack and bundle them, once a week.

The Globe and Mail, for example, has been operating a company-wide recycling program for years now. Special bins at our offices serve the collection of used newspapers. In addition, there's regular pick-up of any unsold newspaper from Globe and Mail dealers across Canada.

Recycling newspapers — it's a significant way to contribute to a better environment. To make a difference.

The Globe and Mail
Canada's National Newspaper

APPENDIX J

Correspondence with

Hamilton-Wentworth Region

PAL-TECH ENGINEERING INC.

47 Elmhurst Drive, Hamilton, Ontario L8T 1C5 • (416) 333-6525 • (416) 383-1728

October 24, 1989

The Regional Municipality
of Hamilton-Wentworth
Department of Engineering
71 Main Street West
Hamilton, Ontario
L8N 3T4

Att: Mr. G. S. Spencer, P. Eng.
Commissioner of Engineering

Re: McMaster Community Recycling Project

Dear Mr. Spencer:

Thank you for spending your time with me during our recent meeting concerning the McMaster University recycling program. As discussed at that time, one of the options being evaluated by PAL-TECH ENGINEERING involves the integration of the proposed campus community program with the current and future recycling activities being conducted by the area municipalities and the Region. As the municipal programs are under review for further development, we request that provision for the participation of the McMaster community be included in your planning arrangements.

If possible, the noted concept may be presented to the recycling co-ordinating committee for their comments, which I would appreciate receiving together with a brief note describing the Region's position in this matter. The information received will be included in my final report to the University in November.

If additional information or discussion is required, please contact me at your convenience.

Sincerely,

PAL-TECH ENGINEERING INC.

Romeo F. Palombella, P. Eng.
President

cc: McMaster University
Att: Mr. R. Crook
Superintendent of Building Operations

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

Department of Engineering
71 Main Street West, Hamilton, Ont. L8N 3T4 (416) 526-4170

Refer to File No E309-20B
Attention of V. Terluk
Your File No

November 27, 1989

Pal-Tech Engineering Inc.
47 Elmhurst Drive
Hamilton, Ontario
L8T 1C5

Att: R.F. Palombella, President

McMaster Community Recycling Project

Gentlemen:

At its recent meeting, the Waste Management Co-ordinating Committee reviewed and approved your request to consider the participation of the McMaster community in the Region's recycling program.

As you are aware the Region has retained the services of WCI Waste Conversion Inc. to prepare the appropriate Terms of Reference to be used in the call for proposals for the supply and delivery of a Region-wide recycling contract. We will request WCI to consider the McMaster Community concept in his preparation of contract documents.

We are planning to make our Call for Proposals before the end of January 1990. A final discussion on the selection of best proposal is not expected until late April or possibly early May, at which time we may require additional information from you and your client in order to properly incorporate your project with the Region's plans.

G.S. Spencer
Commissioner of Engineering

VT/md

cc: J. Kennedy, WCI Waste Conversion Inc.

APPENDIX K

Suggested Activity Priorities

1. Identify most appropriate outlets for wooden pallets, corrugated paper, and fine paper, and proceed with diversion. (Immediate)

2. Obtain formal Administration approval-in-principle of the Recycling Strategy. (Immediate)

3. Submit formal notification of intent to the Region of Hamilton-Wentworth. (Week of Feb. 5)

4. Establish interim Campus Recycling Committee (or Campus Waste Management Committee) to initiate and direct immediate and interim measures. (Immediate)

5. Define, and obtain formal administrative approval for, the selected equipment and personnel resources to be dedicated to the Recycling Strategy. (Immediate)

6. Apply for funding assistance from Provincial/Federal programs. (Immediate)

7. Develop official 4R's policy. (Week of Feb 5 for initiation of process)

8. Interim communications to all campus sectors describing Recycling strategy objectives and providing interim guidelines; including notices in campus printed media. (Immediate)

9. Enact necessary controls over campus printed media production, distribution, and recovery. (Immediate)

10. Reuse office paper internally. (Immediate)

11. Levy an additional charge for disposable beverage cups and/or a discount to encourage cafeteria patrons to provide their own mug. (Immediate)

12. Investigate a pallet return arrangement with suppliers. (Immediate)

13. Improve co-ordination of services and collection for existing recycling depots on campus. (Immediate)

14. Reuse and/or exchange cartons or envelopes among appropriate departments. (Immediate)

15. Hire a Waste Management Co-ordinator. (Subsequent to, or in anticipation of, funding approval).